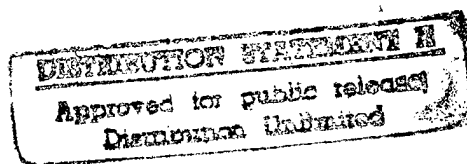


Final Report

WATER CONSERVATION STUDY

**FT. DRUM, NEW YORK
WATERTOWN, NEW YORK**



Prepared for

U.S. Army Engineer District, Norfolk
803 Front Street
Norfolk, VA 23510-1096

Under

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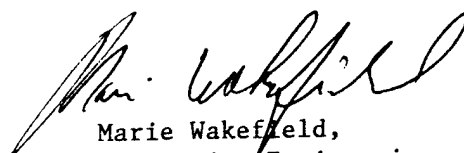

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LIST OF ABBREVIATIONS

| | | |
|------|---|--|
| AC | - | asbestos cement |
| AWWA | - | American Water Works Association |
| COE | - | Corps of Engineers |
| CY | - | cubic yards |
| DANC | - | Development Authority of the North Country |
| ECIP | - | Energy Conservation Investment Program |
| ECO | - | Energy Conservation Opportunity |
| EMC | - | E M C Engineers, Inc. |
| F | - | Fahrenheit |
| FEMP | - | Federal Energy Management Program |
| ft | - | foot, feet |
| gal | - | gallons |
| gpd | - | gallons per day |
| gpm | - | gallons per minute |
| hp | - | horsepower |
| hr | - | hour |
| HVAC | - | heating, ventilating, and air-conditioning |
| hz | - | hertz |
| in | - | inch |
| kgal | - | kilo-gallon, one thousand gallons |
| kW | - | kilowatt, one thousand watts |
| kWh | - | kilowatt-hours, one thousand watt-hours |
| LCCA | - | Life Cycle Cost Analysis |
| LF | - | linear foot (feet), load fraction |
| MES | - | M.E. Simpson Co., Inc. |
| mgd | - | million gallons per day |
| mi | - | mile(s) |
| O&M | - | operation and maintenance manual |
| ppm | - | parts per million |
| PVC | - | polyvinyl chloride |
| RTU | - | remote terminal unit |
| SIOH | - | supervision, inspection and overhead |
| SIR | - | Savings-to-Investment Ratio |
| SOW | - | scope of work |
| SPB | - | simple payback |
| UPS | - | uninterruptible power system |
| UPW | - | Uniform Present Worth factor |
| yr | - | year(s) |

EXECUTIVE SUMMARY

AUTHORIZATION FOR STUDY

This study was conducted and this report prepared under Contract No. DACA01-94-D-0033, Delivery Order No. 0012. The contract was issued by the U.S. Army Engineer District, Mobile, Alabama, to E M C Engineers, Inc. (EMC) on 15 August 1994. The Norfolk District of the Corps of Engineers (COE) has responsibility for this study.

PURPOSE OF STUDY

The purpose of this water conservation study is to conduct a limited site survey and evaluate energy use and savings, estimate construction costs and water savings and provide a cost-to-savings ratio associated with repairing the leaks in the domestic water distribution system at Ft. Drum, New York.

METHOD OF ANALYSIS

Specific work required includes:

1. Perform a limited site survey of the domestic water system to collect data required to identify and evaluate specific energy conservation opportunities (ECOs).
2. Conduct a thorough survey of the potable water system using state-of-the-art underground leak detection equipment on all piping designated by Ft. Drum personnel.
3. Evaluate specific ECOs to determine energy savings potential and economic feasibility.
4. Provide programming documentation for recommended ECOs.
5. Prepare a report to document work performed, and to describe the results and recommendations of the site energy audit and the leak detection study.

LEAK DETECTION SURVEY

A leak detection survey was performed on all water distribution piping designated by Ft. Drum personnel. The leak detection analysis was performed using a combination of listening devices and preamplified-transducer systems to identify the majority of leak

locations. When the location of the leak could not be readily identified using these methods, a leak correlator was used. The leak correlator determines leak location based on the time it takes for sound to travel from the leak to a waterline connection point.

Eighteen leaks were identified by the survey on the water mains within the project scope area. The estimated leakage of 169,000 gallons per day (gpd) was categorized into the following types of leaks:

- One main line leak at 125,000 gpd.
- Two service line leaks at 29,000 gpd.
- One valve leaks at 2,000 gpd.
- Thirteen fire hydrant leaks at 13,000 gpd.

An additional 18,000 gpd of leakage was identified by the leak detection survey in 13 fire hydrants and one additional valve. However, the leak detection crew was able to tighten these appurtenances and eliminate the leaks.

ENERGY CONSERVATION OPPORTUNITIES

Approximately 8.7% of the water usage in the Ft. Drum water distribution system can be attributed to leakage. ECOs were evaluated that would serve to reduce leakage, thereby reducing water production, maintenance, and energy costs.

Description of ECOs

The following ECOs were evaluated for the water distribution system at Ft. Drum:

- ECO 1. Repair the main line and service line water leaks identified in the leak detection survey. One main line leak was located near Building T-2473 on a 12" line. Two service leaks were also identified. All three leaks should be repaired.
- ECO 2. Repair the water valve leak identified in the leak detection survey. One leaking water stub valve was identified and should be replaced.
- ECO 3. Repair fire hydrants which were found to be leaking during the leak detection survey. Thirteen fire hydrants were found to be leaking and should be replaced.
- ECO 4. Repair the main line, valve and fire hydrant leaks. This ECO is a combination of ECOs 1 through 3.
- ECO 5. Implement an annual water audit and leak detection program.

- ECO 6. Connect valve pit actuators to telemetry system to improve circulation. Connection of these valve actuators will allow system operators to automatically open and close valves, providing a low cost solution to stagnation problems in the western end of the old Post.
- ECO 7. Reconnect isolated main line near Oswego Avenue. Approximately 1,200 LF of 12" main line is currently isolated from the system. Reconnection of this segment of piping may serve to improve stagnation problems in the eastern end of old Post.
- ECO 8. Implement policy to optimize the percentage of water produced by Ft. Drum and by the DANC. Optimal quantities of water will be based on cost, water quality, reliability, and O&M requirements.

Economic Analysis

The economic analysis of the ECOs is summarized in Table ES-1 below.

Table ES-1. Summary of ECOs

| ECO No. | Description | Investment Cost (\$) | Annual Water Savings* | Total Discounted Savings (\$) | SIR | Payback (yrs) | First Year \$ Savings |
|---------|-----------------------------|----------------------|-----------------------|-------------------------------|--------|---------------|-----------------------|
| 1 | Repair Main Line Leaks | 2,612 | 56,210 | 623,681 | 238.82 | 0.06 | 46,261 |
| 2 | Repair Valve Leaks | 927 | 730 | 8,100 | 8.74 | 1.54 | 601 |
| 3 | Repair Fire Hydrant Leaks | 35,908 | 4,745 | 52,648 | 1.47 | 9.20 | 3,905 |
| 4 | Repair All Leaks | 39,447 | 61,685 | 684,430 | 17.35 | 0.78 | 50,767 |
| 5 | Implement Leak Detection | 29,120 | 62,621 | 302,564 | 10.39 | 1.30 | 22,417 |
| 6 | Connect Valve Pit Actuators | 3,247 | 396 | 4,394 | 1.35 | 9.96 | 326 |
| 7 | Reconnect Isolated Main | 11,333 | 132 | 1,465 | 0.13 | 104.32 | — |
| 8 | Optimize Ft. Drum vs. DANC | - | - | - | - | - | — |

*Annual Water Savings are in units of thousands of gallons saved per year

\sum_1^6

186,387

124,277

All ECOs, except for ECO 7, display favorable economic payback. That is, they all have SIRs greater than 1.25 and a simple payback of 10 years or less. Based on the qualifications listed by the Scope of Work, these ECOs qualify for government energy conservation funding programs.

RECOMMENDATIONS

The ECOs listed in Table ES-2 are recommended for implementation.

Table ES-2. Recommended ECOs

| ECO No. | Description | Investment Cost (\$) | Annual Water Savings* | Total Discounted Savings (\$) | SIR | Payback (yrs) |
|---------|-----------------------------|----------------------|-----------------------|-------------------------------|-------|---------------|
| 4 | Repair All Leaks | 39,447 | 61,685 | 684,430 | 17.35 | 0.78 |
| 5 | Implement Leak Detection | 29,120 | 62,621 | 302,564 | 10.39 | 1.30 |
| 6 | Connect Valve Pit Actuators | 3,247 | 396 | 4,394 | 1.35 | 9.96 |
| 8 | Optimize Ft. Drum vs. DANC | - | - | - | - | - |

*Annual Water Savings are in units of thousands of gallons saved per year

- **ECO 4.** Replace the main line, valves, and fire hydrants identified as having leaks by the leak detection survey. ECO 4 is a combination of ECOs 1 through 3. Although each of those ECOs are economically feasible based upon their own merits, combining them would simplify the programming documentation and produce a better project.

Note that some of the leaks may have been repaired by maintenance personnel at the time they were discovered by the leak detection survey. Coordination with maintenance personnel will be required to determine which leaks are still in need of repair.

- **ECO 5.** Implement a leak detection program, including a water audit, every year as recommended by the American Water Works Association (AWWA) Manual 36, *Water Audits and Leak Detection*. Implement a policy to immediately excavate and repair all leaks discovered by the leak detection survey.
- **ECO 6.** Connect the water valve actuators in Valve Pit #4 to the telemetry system. Providing automatic control to the valves will allow flow to be alternated between the 16" and 20" main lines that join the old and new Posts. Increased flow through Valve Vault #4 (16" line) should improve water circulation on the western side of the old Post.
- **ECO 8.** Water consumed at Ft. Drum comes from two sources. Water provided by the DANC makes up approximately 75% of the total, while wells at Ft. Drum supply the remaining 25%. Ft. Drum currently pays \$0.82 per thousand gallons of water, which accounts for water produced from the wells at Ft. Drum and also the variable costs of water produced by the DANC. Under an agreement, DANC provides a minimum of 1.5 mgd at a fixed cost according to a schedule provided by Ft. Drum personnel. (The cost in 1995 was \$6.25/kgal. In 1997, after capital costs are paid in full, the cost is estimated to be \$1.49/kgal.)

The total cost of water from both sources was based on a combination of electrical costs, O&M costs, chemical treatment costs, and water storage costs. Calculations show that the total cost of the water produced by both sources decreases as more

well water is produced and less DANC water is used. The cost of water if Ft. Drum supplies 75% of the total water consumed was calculated to be \$0.41 per kgal. The cost of water if Ft. Drum supplies 95% of the total was calculated to be about \$0.24 per kgal.

It is reasonable to maintain an equitable balance between Ft. Drum well water and water supplied by the DANC. If Ft. Drum is able to negotiate a lower guaranteed water production rate from the DANC, it would produce lower annual costs.

In accordance with the SOW, Ft. Drum personnel provided direction regarding the combination of ECOs into projects. They requested that all appropriate ECOs be combined into one project. To be considered appropriate, the synergistic effects of the bundled ECOs must meet government funding criteria with an SIR of 1.25 and a simple payback of 10 years or less. Programming documentation has been prepared for ECOs 4, 5, 6, and 7. The results of the economic analysis for the bundled project are listed in Table ES-3 below.

Table ES-3. Economic Analysis for Bundled Project

| | |
|----------------------------------|-----------|
| Total Investment | \$83,148 |
| Annual Water Savings (kgal/year) | 124,834 |
| Annual Cost Savings | \$73,618 |
| Total Discounted Cost Savings | \$992,857 |
| Simple Payback (years) | 1.13 |
| Savings-to-Investment Ratio | 11.94 |

1. INTRODUCTION

1.1 AUTHORITY FOR STUDY

This study was conducted and this report prepared under Contract No. DACA01-94-D-0033, Delivery Order No. 0012. The contract was issued by the U.S. Army Engineer District, Mobile, Alabama, to E M C Engineers, Inc. (EMC). The Norfolk District of the Corps of Engineers (COE) has responsibility for this study.

1.2 PURPOSE OF STUDY

This project consists of a potable water conservation study for Fort Drum, New York. The tasks required for this include:

- Conduct a limited site survey.
- Conduct a leak detection survey.
- Evaluate water production and consumption at Ft. Drum.
- Evaluate projects which would produce energy and cost savings.
- Estimate construction costs and water savings.
- Provide a cost to savings ratio associated with repairing leaks and water stagnation problems in the domestic water distribution system at Ft. Drum.

This study presents information obtained during an audit and leak detection study of the water distribution system. This study also makes recommendations for corrective actions that could result in energy, operational and maintenance savings. Recommended ECOs presented by this study are based strictly on economic feasibility and life cycle cost analysis.

1.3 BACKGROUND

Ft. Drum is located 10 miles northeast of Watertown, New York, between Lake Ontario and the Adirondack Mountains. Ft. Drum was originally constructed in 1941 and became the home of the 10th Mountain Division in 1984. From 1984 to 1986 Ft. Drum was expanded, creating the "new" Post to the north of Main St. and Oneida Ave. The original Post area is designated as the "old" Post.

In addition to garrisoning the 10th Mountain Division, Ft. Drum is also a major training site for Reserve Components and host to 26 Tenant organizations. The mission statement for Ft. Drum is provided below.

Command, operate, manage, and administer the use of resources to accomplish all assigned missions. Additionally, the garrison provides administrative, logistical, and management support to assigned or attached tenant units and activities to include both on-post and off-post units or activities in the assigned geographic areas.

The mission statement is contained in the Total Army Quality Self Assessment which is included in Appendix A.

Ft. Drum is served by a multi-looped water distribution system. Potable water is distributed throughout the base by approximately 130 miles of piping. The distribution system consists mainly of polyvinyl chloride (PVC) and ductile iron piping. Service and lateral lines are generally constructed of PVC and steel pipe.

The original piping for the old Post was constructed of transite (asbestos cement) piping. A project was performed approximately four years ago to replace the majority of transite piping with ductile iron pipe. In most cases, the transite piping was abandoned in place.

Ft. Drum collects water from a series of 11 wells and stores the water in two elevated water tanks and one below ground reservoir. The Post decommissioned a third elevated water tank. The wells and tanks are connected to a telemetry system where the operation of each segment is optimized.

The Post also receives water from the Development Authority of the North Country (DANC). In an agreement reached between Ft. Drum and the DANC, Ft. Drum purchases a minimum average 1.5 million gallons of water per day (mgd) from the DANC. The DANC operates a pumping station on Ft. Drum which contains a water storage tank, pumps and controls. The controls integrate the DANC system with Ft. Drum's telemetry system.

1.4 SCOPE OF WORK

The Scope of Work (SOW) for this project is included in Appendix A. The major technical criteria identified by the SOW are summarized below:

- Perform a limited site survey on Ft. Drum's water distribution system. Sufficient information should be collected to allow for an adequate understanding of the water system and to identify possible energy conservation opportunities (ECOs) as they are associated with the domestic water distribution system. This information would include as-built drawings, historical usage data, and interviews of on-site personnel.
- Perform an underground leak detection survey on all piping designated by Ft. Drum personnel. The survey should identify the location, type and quantity of all discovered leaks.

- Evaluate identified ECOs to determine their energy savings potential and economic feasibility.
- Provide programming documentation for recommended ECOs.
- Prepare a report to document work performed and to describe the results and recommendations of the site and energy audit and the leak detection study.

1.5 APPROACH

The approach taken in this study is as follows:

1. **Field Survey.** The water distribution system at Ft. Drum was examined to gain an understanding of system operation and maintenance and to determine the condition of the system. Information such as pump nameplate data, as-built drawings, and historical meter data was obtained. On-site personnel were interviewed to ascertain system operation and to define unacceptable conditions, past problems, and future requirements.
2. **Leak Detection Survey.** A survey of all water distribution piping designated by Ft. Drum personnel was performed to determine the location, type, and quantity of leaks. The survey was performed by M.E. Simpson Co., Inc. (MES).
3. **Analysis of Leak Detection Survey.** Data from the leak detection survey was summarized. The location of each leak was documented on individual drawings and the quantities of the leaks were tabulated in a separate table.
4. **ECO Analysis.** Appropriate ECOs were identified and analyzed to determine their economic feasibility. Economic feasibility was judged as a comparison between the investment cost of implementing the ECO and the savings that would result. Cost savings were calculated as the sum of reduced pumping, water treatment, and maintenance costs as a result of reduced water consumption. Criteria outlined by the Energy Conservation Investment Program (ECIP) was used to define economic feasibility. A recommended ECO must have a savings-to-investment ratio (SIR) of 1.25 or better and a simple payback (SPB) of 10 years or less to be considered for government funding.
5. **Interim Report and Review.** The results of the field and leak detection survey, as well as the identification and analysis of ECOs, are to be presented in an Interim Report. The ECOs are to be organized as possible ECIP or Federal Energy Management Program (FEMP) projects.
6. **Final Report.** The incorporation of programming documentation, and the Interim Report constitute the Final Report. Additionally, the results of the government

review will be incorporated into the Final Report. The programming documentation shall be prepared according to the direction given by the client, based on recommendations outlined by the interim report.

2. DESCRIPTION OF EXISTING CONDITIONS

2.1 GENERAL

During the week of 23 October 1995, a field survey was performed by EMC to obtain the necessary information to identify and evaluate possible energy conservation opportunities (ECOs) for the potable water distribution system at Ft. Drum. MES performed a leak detection study of the water distribution system from 24 October to 7 November.

EMC compared the average daily water usage for August 1993 through July 1995 to the leakage rate determined by MES. The calculation determined that approximately 8.7% (169,000 gpd/2.0 mgd) of the water consumption is due to leaks in distribution piping, valves, and fire hydrants. Therefore, the initial focus of the ECOs will seek to reduce water usage by reducing the amount of leakage. Other ECOs are produced as appropriate.

2.1.1 Description of Water Distribution System

Ft. Drum collects high quality, slightly basic, groundwater from a series of 11 wells (reference Table 2-1). The water requires minimal treatment beyond chlorination. The Post stores the water in three reservoirs:

- a 250,000 gallon elevated water tank (old Post);
- a 1 MG elevated water tank (new Post); and,
- a 750,000 gallon below ground reservoir (old Post).

Ft. Drum decommissioned a third elevated water tank in the old Post area. The wells and tanks are connected by a telemetry system whereby the operation of each segment is optimized through criteria developed by Ft. Drum personnel.

The Post also receives water from the DANC. In an agreement reached between Ft. Drum and the DANC, Ft. Drum purchases a minimum average 1.5 million gallons of water per day from the DANC. The 1.5 mgd is an amount that is totalized at the end of the month, therefore, actual daily usage is flexible and optimized using the telemetry system and criteria set forth by Ft. Drum personnel.

The DANC provides treated, slightly acidic, surface water (derived from the Black River) to Ft. Drum from the southwest (Watertown) which travels to a DANC pumping station located at Fourth St. and St. Lawrence Ave. The DANC's pump station contains a water storage tank, pumps and controls. The controls integrate the DANC pump station operation with Ft. Drum's telemetry system. The DANC's water is also stored in Ft. Drum's elevated water tanks and below ground reservoir.

Ft. Drum is served by a multi-looped water distribution system. Potable water is distributed throughout the base by approximately 130 miles of piping. The distribution system, which is approximately 8-40 years old on the old Post and 6-8 years old on the new Post, consists mainly of polyvinyl chloride (PVC) and ductile iron piping. Specifically, the distribution mains (sizes 12"-20") are ductile iron piping. Service and lateral lines are generally constructed of PVC and steel pipe.

At one time, the old Post's water system was constructed of almost entirely asbestos cement (AC) piping. Over the years the AC pipe has been replaced but there are still small stretches of AC piping on Post. There was no information found regarding the location of the AC piping except that it may be located in the 2000 and 2800 areas. The survey did not identify specific AC pipe locations.

Table 2-1. Existing Pump Schedule

| Pump Identification | Motor Manufacturer | Motor Size (hp) | Capacity of Pump (gpm) | *Annual Operating Hours |
|---------------------------------------|--------------------|-----------------|------------------------|-------------------------|
| Pump 2 | Sumo | 40 | 440 | 1,098 |
| Pump 3 | Franklin | 20 | 140 | 2,070 |
| Pump 4 | Franklin | 15 | 80 | 1,585 |
| Pump 5 | Franklin | 40 | 445 | 1,050 |
| Pump 6 | Franklin | 15 | 130 | 1,954 |
| Pump 7 | Franklin | 15 | 160 | 1,315 |
| Pump 8 | Franklin | 15 | 80 | 2,146 |
| Pump 9 | Franklin | 20 | 200 | 1,331 |
| Pump 10 | Franklin | 25 | 230 | 1,676 |
| Pump 11 | Franklin | 40 | 300 | 1,007 |
| Pump 12 | Franklin | 30 | 200 | 1,283 |
| 750,000 gallon reservoir service pump | Westinghouse | 40 | 450 | 2,614 |
| 750,000 gallon reservoir fire pump | Louis Allis | 75 | N/A | 0 |

*Note: The annual operating hours for the well pumps were taken from telemetry system data. The hours shown are the average value for the last two years (August 1993 to July 1995). All pumps provide domestic water service.

2.1.2 Description of Water Distribution System Operation

The Ft. Drum water distribution system telemetry system affords the Ft. Drum personnel a high degree of operational freedom. The personnel are able to:

- Remotely turn on/off any of the 11 pumps.
- Set priority of operation for the pumps.
- Monitor well function, operating hours.
- Monitor tank water elevation.
- Monitor the DANC facility.
- Track water use.
- Prepare a water use data base to spot trends or histories.

The telemetry system items listed above are further explained as follows. The Ft. Drum personnel have set a protocol for the system to determine which pumps should be turned on to meet system demands. As the water level in the water tanks decrease to certain set point elevations, the telemetry system identifies the pump with the fewest hours of operation and turns it on. As the demands of the distribution system increase, the telemetry system identifies each additional pump with the fewest operational hours and turns them on. This continues until the flow rate from the wells is sufficient to meet the water system demand and maintain or increase the water volume in the tanks.

As the water system demand decreases, the telemetry system turns off pumps according to which pump has the highest operational hours. Removal of pumps from the distribution system continues until only one pump is left on to maintain operation of the chlorination system. This type of operation allows the Post to maintain balanced pump operational hours.

All system functions are monitored from the system telemetry office which houses the remote terminal units (RTU), a 20 hour uninterruptible power system (UPS), a CPU, monitor and printer. From the system telemetry office, the Post personnel can "view" the DANC system operation to optimize their water purchases from the DANC.

Since Ft. Drum is required to purchase 1.5 mgd and, if, near the end of the month they lag behind the average daily use rate, they can extend the operation of the DANC pumps (up to 3 mgd, maximum) and increase the daily water intake. By monitoring the system in this manner, the Post won't have to pay for water they don't use. The converse is also true. If they are running ahead of the water use schedule, they may opt to reduce the amount of the DANC water used each day such that they don't have to pay for additional water at the end of the month.

The telemetry system also assists in flow modulating between the old and new Posts. The new Post and old Post water systems are connected at two control valve vaults. The vaults are located on Conway Road and Fourth Street East. The valves in the vault on Fourth Street East are connected to the telemetry system allowing Ft. Drum personnel to operate the valves, as required. The valves in the Conway Road vault are not yet connected to the telemetry system, although they have electric actuators installed. The valves are presently in the closed position, thereby forcing all the flow between the Posts to be channeled through the Fourth Street West valve vault.

There is another pressure reducing valve (PRV) on Lewis Avenue which does not have actuators installed. The PRV is located in the 8300 area.

The final item of note about the existing water system is the closure of a section of pipe on Oswego Avenue. The 1,200 linear foot stretch of line (from Leroyville Road west) is out of commission as a result of repair work done a few years ago. The repair work was conducted, but the line could not be properly chlorinated to allow its reinstatement into the water distribution system.

Ft. Drum personnel have reported low chlorine levels (less than 0.5 ppm) in the water system in the following areas: 0; 100; 1100; 4000; 6000. The Post thinks the problem occurs because the use in these areas has dropped off substantially since the new Post has opened. To relieve the problem, field maintenance personnel have manually opened local fire hydrants which in turn increased the circulation in the area, bringing in more chlorinated water and raising the chlorine level. In other areas this practice is generally used on long dead-end lines, but has proven effective for use in this case.

Historical water usage was taken from operating logs from the telemetry system. Table 2-2 summarizes the total water usage for Ft. Drum from August 1993 to July 1995.

Table 2-2. Average Annual Water Production (August 1993-July 1995)

| | Water Quantity | Percentage of Total |
|--|----------------|---------------------|
| Annual Well Operation (hours) | 16,515 | - |
| Annual Well Production (gal) | 180,282,960 | 25.4 |
| Annual DANC Production - Actual (gal) | 529,017,693 | 74.6 |
| Annual DANC Production - Contractual (gal) | 547,500,000 | - |
| *Total Water Production - Ft. Drum | 709,300,653 | 100.0 |

*Note: Total Ft. Drum water usage was based on actual production amount from DANC, not contractual. Taken from Telemetry System (Datalog No. 3)

A detailed summary of monthly water usage as well as usage data supplied by Ft. Drum can be found in Appendix B.

2.2 LEAK DETECTION SURVEY

EMC contracted MES of Valparaiso, Indiana to perform the leak detection survey on 129 miles of water distribution piping. The survey determined the location, type, and quantity of leaks by examining all fire hydrants, all accessible mainline valves and 30 services.

2.2.1 Method of Analysis

When water escapes from an orifice, it causes a vibration in the 500-800 Hz range. This sound travels along the pipe wall and can be heard a considerable distance away by an observer with the proper equipment. Other sounds (in the 25-250 Hz range) are caused by water striking the soil and swirling around in the cavity it creates. This sound does not travel well along the pipe, and is therefore useful in pinpointing the leak. (Walski, 1984)

Leak detection by listening is qualitative, as there is virtually no correlation between size of leak and intensity of sound. The sound is influenced by such factors as pipe material (metal pipes conduct sound better), soil type, and leak configuration. (Walski, 1984)

MES used a combination of listening devices and preamplified-transducer systems to identify the majority of leak locations during the leak detection survey. When identification of the leaks proved difficult by these means, they used a device called a leak correlator to identify the leak location.

The correlator is used when the leak location(s) are not readily identified by the above methods. The correlator is connected to the waterline at two points. The microprocessor units measure the time it takes for the sound to travel from the leak to the waterline connection point. Since the correlators are connected to the waterline at two points, the precise leak location can be identified.

Using the listening devices and transducers set up on fire hydrants and valve boxes when appropriate, MES "listened" for leaks in the system. The audible noises created when water escapes from a pipe, valve, or hydrant can be deciphered as the source of the leak.

Water flowing through the pipe at the point of use creates similar sounds to water leakage. MES eliminated these water usage sounds from consideration by investigating the general area to locate any normal water usage. If usage was found in the general area, the water supply would have been turned off and the water line retested. If no usage was found in the general area, the sounds would have been attributed to leakage. MES did not have to turn off any water supplies during this survey at Ft. Drum.

When MES located the source of a leak noise, they initially called in an excavating crew to excavate the leak. Once uncovered, the leak rate was estimated by the "bucket and stopwatch method" or by using the experience of the technician. As the leak detection survey progressed through the Post, an excavating crew was not called in for every leak found. The location and size of the leaks were located and noted on a map (enclosed in the pocket). In addition to the "bucket and stopwatch method", the Greeley formula and the "hose and meter" method could also be used. These and other methods used are described in the AWWA Manual 36, *Water Audits and Leak Detection*.

2.2.2 Summary of Results

The water mains within the project scope area were surveyed and seventeen leaks were located. The total leakage quantity was estimated to be 169,000 gallons per day (61,685,000 gallons per year). This translates to approximately 8.7% of the total water usage at Ft. Drum (see Table 2-2). The leakage quantity is summarized in Table 2-3 below.

Table 2-3. Leak Detection Summary

| Type of Leak | No. of Leaks | Size (gpd) | Size (kgal/year) |
|--------------|--------------|---------------|---------------------|
| Main Line | 1 | 125,000 | 45,625 |
| Service Line | 2 | 29,000 | 10,585 |
| Valve | 1 | 2,000 | 730 |
| Fire Hydrant | 13 | 13,000 | 4,745 |
| Total | 17 | 169,000 | 61,685 |

An additional leakage quantity of 18,000 gpd was identified by the leak detection survey. This leakage was found in 13 additional fire hydrants and one additional valve. However, the leak detection crew was able to tighten these appurtenances and eliminate the leaks.

A breakdown of the leakage results and locations of the leaks is contained in Appendix C.

3. WATER SYSTEM ENERGY AUDIT

Ft. Drum receives water from two different sources. Water is provided from the DANC and from wells located at Ft. Drum. Therefore, the cost of water at Ft. Drum is a function of the combined production, maintenance, and capital costs incurred from both sources. Reducing the amount of water lost to leakage can result in energy and cost savings.

The purpose of this energy audit is to investigate possible energy conservation opportunities (ECOs) that would serve to reduce leakage in the distribution system. The energy audit is based on information from two sources, a leak detection survey and a water audit. The leak detection survey was conducted to assess the current quantity of water lost to leakage in main lines, valves, and hydrants. Energy and cost savings will be produced by reducing the amount of leakage. These savings are described in ECOs 1 through 4. The water audit performed in this study estimates potential usage in the distribution system and is the basis for the calculation of ECOs 5 through 8.

3.1 COST CALCULATIONS

The total cost of water at Ft. Drum can be separated into the following categories:

- **Ft. Drum Electrical Charges.** Ft. Drum utilizes eleven wells with electrical motors ranging in size from 15 hp to 40 hp. These wells operate for an average of 16,515 hours per year.
- **Ft. Drum Operation & Maintenance Costs.** These costs include the labor costs associated with operating and maintaining the water treatment plant and water distribution system at Ft. Drum, and includes chemical treatment costs for water produced by the wells.
- **Ground Reservoir Pump Electrical Costs.** There are two pumps which serve the 750,000 gallon ground reservoir. One pump (40 hp) is used to circulate water through the reservoir. The other pump (75 hp) is necessary to maintain water volume in the reservoir in case of excessive demand. This pump has not been used for several years. The electrical costs (per thousand gallons, or kGal, of water) for these reservoir pumps are calculated separately from the well pumps because they serve water produced from both the wells and from the DANC.
- **DANC Costs.** Ft. Drum contractually pays for a minimum 1.5 mgd of the DANC water. The cost of the water is comprised of fixed and variable costs incurred by the DANC and by the City of Watertown. For this report, the DANC and the City of Watertown fixed costs are the capital costs incurred to build the capital improvements to the system. The variable costs are those costs which vary

according to the amount of water produced, such as the operation, maintenance, and overhead charges.

Projects that are analyzed using the Energy Conservation Investment Program (ECIP) criteria must differentiate between energy and non-energy savings because different discount rates apply to each over the economic life of the ECO. Therefore, electrical, operation and maintenance, and water production cost savings for water produced at Ft. Drum and the DANC were calculated separately in units of cost per gallons. In calculating water costs in terms of dollars per gallon, a cost savings can be calculated based on the amount of water saved by an ECO.

3.1.1 Ft. Drum Electrical Costs

The electrical rates paid by Ft. Drum were provided by the utility office at Ft. Drum. The electrical rates were broken into the following charges:

- Monthly customer charge: \$3,172/month (minimum charge)
- Demand charge: \$7.02/kW
- On peak electrical consumption charge: \$0.06196/kWh
- Off peak electrical consumption charge: \$0.05197/kWh
- Bundled electrical charge: \$0.072/kWh.

EMC was directed by the utility office to use the bundled electrical charge when performing energy and cost savings calculations for potential ECIP/FEMP projects. This bundled charge takes into account all demand, consumption, and customer charges incurred by Ft. Drum. EMC was directed by the utility office not to use the other electrical charges (such as off-peak electrical consumption) for energy and cost savings calculations. Because of this direction, ECOs regarding pumping during non-peak hours were not included in this energy audit.

There are eleven wells currently in operation at Ft. Drum. The electrical operating cost for the well pumps was calculated using the following equation:

$$Cost = \sum_{AllWells} \frac{(hp)(0.746)(LF)(Hours)(\$0.072 / kWh)}{EFFM}$$

where:

| | | |
|---------|---|---|
| hp | = | nameplate horsepower, |
| 0.746 | = | conversion factor relating kilowatts to horsepower, |
| LF | = | load factor (assume 75% average), |
| Hours | = | annual operating hours, taken from telemetry data |
| \$0.072 | = | bundled energy cost (\$/kWh), and |
| EFFM | = | motor efficiency (standard efficiency). |

Based on the telemetry data from August 1993 to July 1995, the wells operated an average of 16,515 hours per year, which translates into an electrical consumption of 241,671 kWh. At the bundled electrical cost of \$0.072/kWh, the annual electrical cost for operating all eleven wells was \$17,400. Based on a total water production of 180,282,960 gallons (see Table 2-2), the total electrical cost of the water produced from the wells at Ft. Drum is \$0.097 per kgal.

3.1.2 Ft. Drum Operation and Maintenance Costs

The total operation and maintenance (O&M) costs were provided by Ft. Drum personnel. These costs include labor and equipment costs for upgrading and maintaining the water treatment plant and distribution system. Also included is the cost for chemical treatment of the water produced by the wells at Ft. Drum.

The total O&M costs reported by Ft. Drum follows:

- Fiscal Year 1994: \$22,127
- Fiscal Year 1995: \$25,655
- Chemical Treatment (1995): \$5,550 (included in FY-95 costs)

Operation and maintenance costs were applied to water produced from the wells at Ft. Drum and from the DANC. Chemical treatment costs were only applied to water produced from the wells. Based on a total water production of 709,300,653 gallons (see Table 2-2) and FY-1995 costs (\$20,105, without chemical treatment costs), the cost for O&M of the water distribution system at Ft. Drum was calculated to be \$0.028 per kgal. The cost for chemical treatment of only the 180,282,960 gallons of water per year produced by the Ft. Drum wells was found to be \$0.031 per kgal.

3.1.3 Ground Reservoir Pump Electrical Costs

There are two pumps which serve the 750,000 gallon ground reservoir at Ft. Drum. One pump (40 hp) is used to circulate water through the reservoir. The other pump (75 hp) is necessary to maintain water volume in the reservoir in case of excessive demand. This pump has not been used for several years.

The equations used to calculate energy costs are identical to those used to calculate energy costs for the well pumps in Section 3.1.1. Based on telemetry data from August 1993 to July 1995, the 40 hp pump operates for an average of 2,614 hours per year, which translates into an electric consumption of 65,365 kWh. Based on the number of annual operating hours and an average flow rate of 450 gpm, the pump was assumed to circulate 70,578,000 gallons of water per year. Based on the bundled electrical cost of \$0.072/kWh, the total annual electrical cost is \$4,706.

The only difference between the electrical cost calculations for the reservoir pump and the well pumps is that the reservoir pump serves water produced from both the well pumps and from the DANC. Therefore, the total electrical cost for the reservoir pump (based on the total production of 70,578,000 gallons per year) was \$0.067 per kgal.

3.1.4 DANC Water Costs

The DANC built and maintains booster pumping stations at Ft. Drum and near the City of Watertown, as well as a pipeline which connects the two stations. The booster station at Ft. Drum consists of an above-ground storage tank and a building which houses three booster pumps, controls and chemical treatment equipment. Under a contractual agreement, Ft. Drum is obligated to pay a fee (per kgal of water produced) for a minimum of 1.5 mgd from the DANC (reference DANC Schedule "A", located in Appendix B). The fee charged for the water is comprised of several costs incurred by the DANC and City of Watertown. The total cost includes fixed and variable costs. The costs are described in detail below.

- **DANC Electrical Costs.** Includes electrical costs for operating three booster pumps at the DANC booster pumping station at Ft. Drum and at the booster station off-Post. For the purposes of this study, the electrical costs are considered variable. That is, the cost depends upon the amount of electricity consumed, which is dependent upon the amount of water produced.
- **DANC O&M Costs.** Includes operation and maintenance costs for the booster pumping stations and the pipeline which connects them. For the purposes of this study, the O&M costs are considered variable costs.
- **Overhead Costs.** Includes the DANC assigned overhead costs. For the purposes of this study, the overhead costs were assumed to be variable.
- **DANC Capital Costs.** Includes capital costs incurred by the DANC for construction of their water distribution system. For the purposes of this study, the DANC capital costs were assumed to be fixed.
- **City of Watertown Capital Costs.** Includes capital costs incurred by the City of Watertown for construction of the DANC's water distribution system. For purposes of this study, the city's capital costs are also assumed to be fixed.

The assumption was made for this study that the fixed (capital) costs were incurred upon construction of the booster stations and the pipeline. Because these costs have already been incurred, it was assumed that Ft. Drum is obligated to pay them in full according to the schedule provided by the DANC. It is unlikely that either the amount or the schedule of payment of the incurred fixed costs are negotiable. Because these fixed costs must be paid regardless of the amount of water consumed, it was assumed that any water savings

resulting from implementation of the ECOs in this study would not include DANC's fixed costs as savings.

A schedule of the current and anticipated fees paid to the DANC was provided by Ft. Drum personnel. The costs that comprise the total fee for water provided by the DANC for the period 1 April 1995 to 31 March 1996 are listed in Table 3-1.

Table 3-1. Total Cost of Water Provided by the DANC (April 1995 - March 1996)

| Description | Type of Cost | Total Cost (\$) | Total Cost (\$/kgal) |
|---------------------------------|--------------|--------------------|----------------------|
| DANC Capital Costs | Fixed | 2,632,305 | 4.81 |
| City of Watertown Capital Costs | Fixed | 314,049 | 0.57 |
| Total Fixed Cost | - | 2,946,354 | 5.38 |
| DANC Overhead Costs | Variable | 86,203 | 0.157 |
| DANC O&M Costs | Variable | 167,451 | 0.306 |
| City of Watertown O&M Costs | Variable | 222,873 | 0.407 |
| Total Variable Cost | - | 476,527 | 0.87 |
| Total Cost | - | \$3,422,886 | \$6.25 |

Costs taken from Schedule 'A', provided by Ft. Drum personnel. Costs (\$/kGal) were based on water production of 547,500 kGal per year.

It is assumed that any water savings resulting from implementation of the ECOs would result in variable cost savings for the water produced from the DANC. Therefore, for a variable cost of \$476,527 and an actual water production of 529,017,693 gallons per year (see Table 2-2), the cost of DANC water is **\$0.90 per kgal**.

All of the ECOs are based upon the total cost of water consumed at Ft. Drum, which is a combination of Ft. Drum well water and water provided by the DANC. Since Ft. Drum is currently obligated to pay for an minimum of 1.5 mgd, it should be noted that the ECOs may produce a more favorable economic payback if the DANC contract is renegotiated to exclude the minimum quantity restrictions.

3.1.5 Total Water Costs

Water savings produced by recommended ECOs will be applied to the total amount of water at Ft. Drum, regardless of the source. It is unrealistic to separate water savings and apply it to separate cost categories. Therefore, the total cost of water consumed at Ft. Drum must be prorated to accurately represent actual water production.

It is reasonable to assume that the capital (fixed) costs charged by the DANC will remain unchanged because they are being applied to costs previously incurred for construction. Therefore, fixed costs charged by the DANC and by the City of Watertown are not included in the cost of water calculation. The total cost of the water consumed at Ft. Drum

was based on the costs attributed to water produced at Ft. Drum and the variable costs charged by the DANC. Table 3-2 illustrates the total water cost calculation.

Table 3-2. Total Cost of Water - Ft. Drum

| Cost Category | Cost (\$/kgal) | Actual Water Production (gal) | Percentage of Total Production | Prorated Cost (\$/kgal) |
|-----------------------------|----------------|-------------------------------|--------------------------------|-------------------------|
| Drum Electrical | 0.097 | 180,282,960 | 25.4 | \$0.025 |
| Drum O&M | 0.028 | 709,300,653 | 100.0 | \$0.028 |
| Ft. Drum Chemical Treatment | 0.031 | 180,282,960 | - | \$0.031 |
| Reservoir Pump | 0.067 | 70,578,000 | - | \$0.067 |
| DANC (variable) | 0.90 | 529,017,693 | 74.6 | \$0.672 |
| Total | - | - | - | \$0.82 |

The total water cost at Ft. Drum was calculated to be **\$0.82 per kgal.**

A copy of the cost calculations and cost backup data provided by Ft. Drum and the DANC can be found in Appendix D of this report.

3.2 LIFE CYCLE COST ANALYSIS METHODOLOGY

Economic analysis was performed in accordance to the January 1994 ECIP guide. Uniform present worth factors are based on a 4.1% discount factor and were taken from Table 2, Census Region 1 (New York), of the NISTIR 85-3273-10, *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis 1996 (Oct. 1995)*. Uniform present worth (UPW) factors for non-energy costs were taken from Table A-2. The economic life of equipment was taken from Appendix B of the ECIP guide. A copy of the life cycle discount factors and calculations can be found in Appendix D.

ECO construction costs were prepared using Means Mechanical Cost Data 1996. Location factors for Watertown, New York, were applied to all material and labor costs. Additional markups used for the LCCA include:

- 20% for overhead and bond
- 10% for profit
- 10% for contingency
- 6% for Supervision, Inspection, and Overhead (SIOH)
- 6% for design costs

3.3 ENERGY CONSERVATION OPPORTUNITIES

The following ECOs were evaluated for the water distribution system at Ft. Drum:

- ECO 1. Repair the main line and service line water leaks identified in the leak detection survey. One main line leak was located near Building T-2473 on a 12" line. Two service leaks were also identified. All three leaks should be repaired.
- ECO 2. Repair the water valve leak identified in the leak detection survey. One leaking water stub valve was identified and should be replaced.
- ECO 3. Repair fire hydrants which were found to be leaking during the leak detection survey. Thirteen fire hydrants were found to be leaking and should be replaced.
- ECO 4. Repair the main line, valve and fire hydrant leaks.
- ECO 5. Implement an annual water audit and leak detection program.
- ECO 6. Connect valve pit actuators to telemetry system to improve circulation. Connection of these valve actuators will allow system operators to automatically open and close valves, providing a low cost solution to stagnation problems in the 8500 Area of the old Post.
- ECO 7. Reconnect isolated main line near Oswego Avenue. Approximately 1,200 LF of 12" main line is currently isolated from the system. Reconnection of this segment of piping may serve to alleviate stagnation problems in the old Post.
- ECO 8. This is a no cost ECO. Implement a policy to optimize the proportion of water produced by Ft. Drum and by the DANC. Optimal quantities of water will be based on water quality, reliability, and cost.

3.4 RECOMMENDED ECOs

ECOs 1 through 6 and ECO 8 were found to be economically feasible based on ECIP criteria, and are recommended for implementation.

3.4.1 ECO 1: Repair Main and Service Line Leaks

Proposed Modifications: Repair main line and service line water leaks identified in leak detection survey.

Existing Conditions: The leak detection survey located one main line and two service line leaks in the water distribution system. The total leakage quantity attributed to the main line leak was estimated at 125,000 gpd, while the service line leaks were estimated at 29,000 gpd. The complete leak detection report can be found in Appendix C.

Method of Analysis: Analysis proceeded as follows:

- The total quantity of the main line and service line leaks located by the leak detection survey was summarized and located on a site location map.
- Cost estimates were performed to determine the cost of repairing these pipes. Costs for site work were included with the costs for patching the leaks.
- A Life Cycle Cost Analysis (LCCA) was performed to determine the life cycle cost of repairing the leaks located by the leak detection survey. **Note: The leak detection survey was performed in November 1995. It is possible that new leaks have occurred in the interim while some of the old leaks may have been repaired. The economic analysis is strictly based on the leakage quantities identified by the leak detection survey.**

Results: Table 3-3 below summarizes the economic analysis. The LCCA, cost estimate, and calculation of total leakage savings can be found in Appendix D.

Table 3-3. ECO 1 Economic Analysis

| | |
|----------------------------------|-----------|
| Total Investment | \$2,612 |
| Annual Water Savings (kgal/year) | 56,210 |
| Annual Cost Savings | \$46,261 |
| Total Discounted Cost Savings | \$623,681 |
| Simple Payback (years) | 0.06 |
| Savings-to Investment Ratio | 238.82 |

ECIP/FEMP funding qualifications require an ECO candidate to have a simple payback of 10 years or less and an SIR of 1.25 or better. This ECO meets government funding criteria.

It is important to note that some of the main line leaks may have been repaired by maintenance personnel at the time they were discovered by the leak detection survey. Coordination with maintenance personnel will be necessary to determine which leaks are still in need of repair.

3.4.2 ECO 2: Repair Water Valve Leaks

Proposed Modifications: Repair water valve leaks identified in leak detection survey.

Existing Conditions: The leak detection survey identified one water valve leak. The total leakage quantity was estimated at 2,000 gpd. The complete leak detection report can be found in Appendix C.

Method of Analysis: Analysis proceeded as follows:

- The water valve leak located by the leak detection survey was identified and located on site location maps.
- A cost estimates was performed to determine the cost of replacing the valve. Costs for site work were included with the cost for replacing the valve.
- A Life Cycle Cost Analysis (LCCA) was performed to determine the life cycle cost of repairing the leaks located by the leak detection survey. **Note: The leak detection survey was performed in November 1995. It is possible that new leaks have occurred in the interim while some of the old leaks may have been repaired. The economic analysis is be strictly based on the leakage quantities identified by the leak detection survey.**

Results: Table 3-4 below summarizes the economic analysis. The LCCA, cost estimate, and calculation of total leakage savings can be found in Appendix D.

Table 3-4. ECO 2 Economic Analysis

| | |
|----------------------------------|---------|
| Total Investment | \$927 |
| Annual Water Savings (kgal/year) | 730 |
| Annual Cost Savings | \$601 |
| Total Discounted Cost Savings | \$8,100 |
| Simple Payback (years) | 1.54 |
| Savings-to Investment Ratio | 8.74 |

ECIP/FEMP funding qualifications require an ECO candidate to have a simple payback of 10 years or less and an SIR of 1.25 or better. This ECO meets government funding criteria.

It is important to note that the valve leak may have been repaired by maintenance personnel at the time it was discovered by the leak detection survey. Coordination with maintenance personnel will be necessary to determine which leaks are still in need of repair.

3.4.3 ECO 3: Repair Fire Hydrant Leaks

Proposed Modifications: Repair fire hydrant leaks identified in leak detection survey.

Existing Conditions: The leak detection survey located thirteen fire hydrant leaks. The total leakage quantity was estimated at 13,000 gpd. The complete leak detection report can be found in Appendix C.

Method of Analysis: Analysis proceeded as follows:

- The total quantity of all fire hydrant leaks located by the leak detection survey was summarized and located on site location maps.
- Cost estimates were performed to determine the cost of replacing the leaking fire hydrants. Costs for site work were included with the costs for replacing the hydrants.
- A Life Cycle Cost Analysis (LCCA) was performed to determine the life cycle cost of repairing the leaks located by the leak detection survey. **Note: The leak detection survey was performed in November 1995. It is possible that new leaks have occurred in the interim while some of the old leaks may have been repaired. The economic analysis is strictly based on the leakage quantities identified by the leak detection survey.**

Results: Table 3-5 summarizes the economic analysis. The LCCA, cost estimate, and calculation of total leakage savings can be found in Appendix D.

Table 3-5. ECO 3 Economic Analysis

| | |
|----------------------------------|----------|
| Total Investment | \$35,908 |
| Annual Water Savings (kgal/year) | 4,745 |
| Annual Cost Savings | \$3,905 |
| Total Discounted Cost Savings | \$52,648 |
| Simple Payback (years) | 9.20 |
| Savings-to Investment Ratio | 1.47 |

ECIP/FEMP funding qualifications require an ECO candidate to have a simple payback of 10 years or less and an SIR of 1.25 or better. This ECO meets government funding criteria.

3.4.4 ECO 4: Repair Main Line, Service Line, Valve, and Fire Hydrant Leaks

Proposed Modifications: Repair all leaks identified in leak detection survey.

Existing Conditions: The leak detection survey located one main line leak, two service line leaks, one valve leak, and thirteen fire hydrant leaks. The total leakage quantity was estimated at 169,000 gpd. The complete leak detection report can be found in Appendix C.

An additional number of valves and fire hydrants were discovered to be leaking. However, the leaks stopped once these appurtenances were tightened. The estimated leakage total of 18,000 gpd for these particular valves and fire hydrants were not included in the economic analysis.

Method of Analysis: Analysis proceeded as follows:

- The total quantity of all leaks located by the leak detection survey was summarized and located on site location maps.
- Cost estimates were performed to determine the cost of repairing the leaks. Costs for site work were included with the repair costs.
- A Life Cycle Cost Analysis (LCCA) was performed to determine the life cycle cost of repairing the leaks located by the leak detection survey. **Note: The leak detection survey was performed in November 1995. It is possible that new leaks have occurred in the interim while some of the old leaks may have been repaired. The economic analysis is strictly based on the leakage quantities identified by the leak detection survey.**

Results: Table 3-6 below summarizes the economic analysis. The LCCA, cost estimate, and calculation of total leakage savings can be found in Appendix D.

Table 3-6. ECO 4 Economic Analysis

| | |
|----------------------------------|-----------|
| Total Investment | \$39,447 |
| Annual Water Savings (kgal/year) | 61,685 |
| Annual Cost Savings | \$50,767 |
| Total Discounted Cost Savings | \$684,430 |
| Simple Payback (years) | 0.78 |
| Savings-to Investment Ratio | 17.35 |

ECIP/FEMP funding qualifications require an ECO candidate to have a simple payback of 10 years or less and an SIR of 1.25 or better. This ECO meets government funding criteria.

3.4.5 ECO 5: Implement Leak Detection Program

Proposed Modifications: Implement a water audit followed by a leak detection program on an annual basis. This audit is based upon actual and theoretical water consumption values and is used to establish a baseline (minimum value) of expected water leakage rate. When the actual values of water consumption are well known, thereby reducing the number of theoretical values, the amount of recoverable water distribution system leakage can be readily and accurately identified.

Existing Conditions: A water audit was performed on the potable water system according to guidelines set by the American Water Works Association (AWWA) Manual 36, "Water Audits and Leak Detection." The audit was based on information supplied by Ft. Drum personnel. Water usage in the potable water system can be separated into the following categories:

- **Domestic Water Consumption.** The amount of water consumed by all military and civilian occupants of Ft. Drum was estimated. Demographic data, obtained from Ft. Drum, provided the number of people who occupy the base. These demographics, taken from the Total Army Quality Self-Assessment (1995), were separated into active duty military and civilian personnel, family members, military retirees, and reserve component personnel. Assumptions were made to determine the number of residents and non-residents and are listed in Appendix D.

According to guidelines in Army Technical Manual TM 5-813-1, "Water Supply Sources and General Considerations," the design allowances for water consumption are 150 gpd per person for residents and 50 gpd per person for non-residents. Multiplying these design allowances by the number of residents and non-residents produced an estimate of the amount of water consumed for domestic use.

- **Metered Water Usage.** Water usage for specific buildings on Post is metered. Examples of these buildings would be the PX, Mini Mall, Commissary, The Inn at Ft. Drum, and the central plant. Ft. Drum personnel provided meter data for 15 buildings over the last two years. The average water usage over the last two years was used for this water audit. For purposes of this study, the Metered Water Usage is in addition to Domestic Water Consumption.
- **Fire Hydrants.** According to Ft. Drum fire station personnel, there is no annual program for exercising fire hydrants. Water was assumed to be consumed through the fire hydrants for two purposes at Ft. Drum:
 - ◇ **Fire Protection.** Hydrants are opened by the fire department as requested or as necessary to provide fire protection to the Post. Because no records of hydrant use was found, it was assumed that the hydrants are used 8 hours per year for the purpose of fire protection. It was assumed that the hydrants have a flow rate of approximately 1,200 gpm, based on hydrant test data provided by fire station personnel. The product of the hydrant flow rate and amount of time required was calculated to be the total water usage per year.
 - ◇ **Maintenance.** Maintenance personnel also open the hydrants for maintenance reasons or to improve water circulation within a specific area, thus improving chlorine residuals. It was assumed that each hydrant was opened approximately twice a week during the summer months, which was assumed to be May through September (22 weeks). It was also assumed that

a hydrant is opened for approximately ten minutes at a time. Based on the hydrant flow rate of approximately 1,200 gpm, the total water usage per year attributed to hydrant maintenance was calculated.

- **Once-through Cooling Units.** Domestic water is used for cooling in the condenser units of six HVAC and refrigeration units throughout the Post. The size of these units, annual operating hours, and domestic water requirements for each unit is summarized in Table 3-7. This information was provided by personnel in the HVAC Shop at Ft. Drum.

Table 3-7. Once-through Cooling Units

| Type/Size of Unit | Water Usage (gpm) | Annual Hours | Annual Water Usage (gal) |
|---------------------|-------------------|--------------|--------------------------|
| 3 ton HVAC | 7.5 | 1,000 | 450,000 |
| 10 ton HVAC | 25 | 1,000 | 1,500,000 |
| (4) Walk-in Coolers | 30 (total) | 2,500 | 4,500,000 |

- **Landscaping/Irrigation Water.** From mid-May through September, water from the distribution system is used to irrigate lawns at the headquarters buildings, parade fields and athletic fields at Ft. Drum. Assumptions were made for the number of sprinkler heads that serve each area, the flow produced by each sprinkler head, and the amount of time required for each sprinkler cycle. The product of these assumptions produced a total water usage estimate.
- **Discovered leaks.** According to Ft. Drum personnel, no documented water main breaks have occurred in the water distribution system over the past two years. Therefore, water loss attributed to discovered water main breaks was assumed to be negligible.

Table 3-8 summarizes the results of the water audit of the domestic water system.

Table 3-8. Water Audit Results

| Potable Water Uses | Gallons Per Year |
|--|--------------------|
| Total Water Produced* | 709,300,653 |
| Domestic Water Consumption | 596,420,000 |
| Metered Water Uses | 17,308,500 |
| Fire Hydrants (Fire Protection) | 576,000 |
| Fire Hydrants (Maintenance) | 528,000 |
| Once-through Cooling Units | 6,450,000 |
| Landscaping/Irrigation | 4,524,000 |
| Total Identified Water Consumed | 625,806,500 |
| Potential Water System Losses | 83,494,153 |

| | |
|----------------------------|-------------------|
| Recoverable Leakage | 62,620,615 |
|----------------------------|-------------------|

*Total Water Produced: Quantity taken from telemetry data (Datalog No. 3)

Method of Analysis: Analysis proceeded as follows:

- A water audit was performed on the potable water system according to AWWA Manual 36. All water usage in the audit was based on information obtained from Ft. Drum personnel.
- The amount of recoverable leakage was estimated. According to AWWA Manual 36, recoverable leakage is defined as approximately 75% of all potential losses in the system. For this audit, it was assumed that all potential losses, which are equal to the total water produced minus the total identified water consumed, outlined in Table 3-6, can be fully attributed to potential leakage.
- The total beneficial cost of repairing recoverable leakage was calculated. The cost of water was assumed to be the costs that vary with the amount of water delivered to the potable water system. These include operation, maintenance, and energy costs. The cost of leak repair, however, is not included. Because leaks are continually discovered and repaired in the normal course of operations, the leaks found in the leak detection program would eventually be repaired (AWWA Manual 36). If the leaks are repaired as part of a leak detection program, the expense of repairing leaks as they are accidentally discovered is avoided. Although some cost savings would be realized in fixing the leaks when they are discovered by a leak detection program, as opposed to discovering them accidentally, AWWA Manual 36 allows the auditor to assume that the savings is negligible.
- The total payback of the leak detection program was calculated by dividing the total cost of the leak detection program by the cost savings of recovered leakage. The total cost of the leak detection survey was taken from cost information provided by AWWA and from the average cost of the contractor's bids for the leak detection survey performed at Ft. Drum. The cost of a leak detection survey was calculated to be \$200 per mile of pipe surveyed.

Results: The water audit estimated that 11.8% of the Ft. Drum water production is attributable to water lost due to leakage, and 8.8% is recoverable. Table 3-9 below summarizes the results of the economic analysis. The LCCA and water audit worksheets can be found in Appendix D.

Table 3-9. ECO 5 Economic Analysis

| | |
|--|------------|
| Amount of Recoverable Leakage (gal/yr) | 62,620,615 |
| Cost of Domestic Water (\$ / kgal) | \$0.82 |
| Total Cost of Leak Detection Program | \$29,120 |
| Annual Cost Savings | \$22,417 |
| Total Discounted Cost Savings | \$302,564 |
| Simple Payback (years) | 1.30 |
| Savings-to-Investment Ratio | 10.39 |

ECIP/FEMP funding qualifications require an ECO candidate to have a simple payback of 10 years or less and a savings-to-investment ratio (SIR) of 1.25 or better. Therefore, this ECO meets government funding criteria.

3.4.6 ECO 6: Connect Valve Pit Actuators to Telemetry System

Proposed Modifications: Provide sufficient labor hours to allow Ft. Drum personnel to connect existing valve actuators to the telemetry system. Automatic control of valves connecting the old and new Posts will allow for improved circulation, thus alleviating stagnation problems that are occurring in certain areas of the old Post.

Existing Conditions: Ft. Drum is currently experiencing problems with stagnating water and low chlorine residuals in certain areas of the old Post, especially on the western portion of the old Post (which includes Areas 0, 100, 1100, 4000 and 6000). Improvements in water quality in these areas will most likely improve the water quality in Areas 8300-8500, which have also had some stagnation problems.

There are three main lines that connect the water distribution systems of the old and new Posts:

- Valve Vault #3. This is a 20" main line connection that runs through Area 4400, near Fourth Street East. Within the valve vault, the 20" line enters, separates and connects to two 16" control valves, and then is recombined into a 20" main line, which exits the vault. The electric actuators on the control valves have been installed and connected to the telemetry system, allowing for automatic control.
- Valve Vault #4. This is a 16" main line connection that runs through Area 4300, near Conway Road. Within this valve vault, the 16" line enters, separates and connects to two 12" control valves, and then is recombined into the 16" main line, which exits the vault. There are also two 3" lines which bypass the 12" control valves, and are used in periods of low flow. The electric actuators on the control valves have been installed but are not connected to the telemetry system. Currently the 12" control valves are closed, which forces most of the water flow

to the new Post through Valve Vault #3. The 12" control valves must be manually opened by maintenance personnel.

- Valve Vault. This is an 8" main line connection that runs through Areas 8300 - 8500, near Lewis Avenue.

The stagnation problem is thought to arise from two conditions. The first condition is the decreased flow of water through the old Post. The low water demand has been created from the shift of activity at Ft. Drum to the new Post. The lower the demand, the slower the turnover rate of the water in the area's lines, creating stagnated water. Secondly, the entire flow between Posts occurs through Valve Vault #3. Since the actuators in Valve Vault #4 are not connected to the SCADA system, flow cannot be regulated between Valve Vault #3 and #4. The valves in Valve Vault #4 are usually closed thereby creating a short circuit condition in the flow of water between the Posts.

The plumbing shop personnel want to automatically alternate or combine water flow through Valve Vaults #3 and #4. Water flow through Valve Vault #4 would enhance water circulation and mixing towards the west end of the old Post, thus alleviating some of the stagnation problems. Connecting the actuators in Valve Vault #4 to the SCADA system will allow the automatic actuation of the valves required to enhance water mixing and flow through the old Post.

The FM and hardware connections required to connect the actuators in Valve Vault #4 to the telemetry system have already been procured. Only labor is required to complete the connection.

Method of Analysis: Analysis proceeded as follows:

- The amount of water lost annually for the purpose of alleviating stagnation in the water distribution system at Ft. Drum was estimated. According to the water audit performed in Section 3.3.1.5 of this report, approximately 528,000 gallons of water was lost through hydrants for the purpose of alleviating stagnation in water distribution piping or for maintenance reasons. Specific data on the number of times that the hydrants were opened was not available. Therefore, it was assumed that 75% of the total hydrant exercises occurred specifically for the purpose of improving water circulation in the western area of the old Post. Based on the assumption that 528,000 gallons of water per year was used for hydrant exercising, it was determined that approximately 396,000 gallons of water could be saved by implementing this ECO.
- A cost estimate was performed to calculate the cost of implementing this ECO. According to conversations with plumbing shop personnel, it is estimated that three to four people would be required for about two weeks to properly connect the wiring and fine-tune the telemetry system data. Labor costs were based upon the rate listed for an electrician in Means Mechanical Cost Data (1996).

Because this is anticipated to be an internal project at Ft. Drum, subcontractor's markups such as overhead, profit and contingency were not added to this particular cost estimate.

- A Life Cycle Cost Analysis (LCCA) was performed to determine the economic feasibility of implementing this ECO. Cost savings was based upon the estimated quantity of water saved from hydrant exercising each year.

Results: Table 3-10 below summarizes the economic analysis. The LCCA, cost estimate, and calculation of total water savings can be found in Appendix D.

Table 3-10. ECO 6 Economic Analysis

| | |
|----------------------------------|---------|
| Total Investment | \$3,247 |
| Annual Water Savings (kgal/year) | 396 |
| Annual Cost Savings | \$326 |
| Total Discounted Cost Savings | \$4,394 |
| Simple Payback (years) | 9.96 |
| Savings-to Investment Ratio | 1.35 |

FEMP funding qualifications require an ECO candidate to have a simple payback of 10 years or less and an SIR of 1.25 or better. Based on the assumed labor rate taken from Means Mechanical (1996), it was determined that a maximum of approximately 90 total man-hours could be used before the project would become economically unfeasible (that is, before the project would display an SIR of less than 1.25).

3.4.7 ECO 8: Optimizing Ft. Drum and DANC Water Production

Proposed Modifications: Determine the most equitable proportion of water produced by Ft. Drum and by the DANC. Optimal quantities of water will be based on water quality, reliability, and costs.

Existing Conditions: Ft. Drum is currently under contract to pay a fixed fee to the DANC for the water it provides. This fee is based on a number of costs incurred by the DANC, including:

- DANC Electrical Costs
- DANC O&M Costs
- DANC Overhead Costs
- DANC Capital Costs
- City of Watertown Capital Costs

The cost of water provided by the DANC was taken from the Water Line Schedule "A", which is included in Appendix D. The overall cost varies as the capital, overhead, and O&M charges are applied at different rates and over different periods of time. The overall cost will decrease significantly in 1997 when the balance of the DANC's capital costs are paid in full. However, as stated in Section 3.1.4 of this report, capital costs charged by the DANC are considered fixed costs and must be paid regardless of the amount of water produced. Therefore, only the variable costs were considered in the calculation of the cost of water at Ft. Drum. The cost of water provided by the DANC for the next five years is listed in Table 3-11. A complete listing of the anticipated DANC water costs for the next 20 years can be found in Appendix D.

Table 3-11. DANC Water Costs (1995 - 2000)

| Date | City Capital Cost | DANC Capital Cost (\$) | DANC Overhead Cost (\$) | City O&M Cost (\$) | DANC O&M Cost (\$) | Total Variable Cost (per kgal) | Total Cost (\$/kgal) |
|-------------|-------------------------|------------------------------|-------------------------------|--------------------------|--------------------------|---|----------------------------|
| 4/95 - 3/96 | 314,049 | 2,632,305 | 86,203 | 222,873 | 167,451 | 0.87 | 6.25 |
| 4/96 - 3/97 | 314,049 | 1,535,136 | 88,359 | 228,384 | 171,637 | 0.89 | 4.27 |
| 4/97 - 3/98 | 314,049 | 0 | 90,567 | 234,093 | 175,928 | 0.91 | 1.49 |
| 4/98 - 3/99 | 314,049 | 0 | 92,831 | 239,946 | 180,326 | 0.94 | 1.51 |
| 4/99 - 3/00 | 314,049 | 0 | 95,152 | 243,944 | 184,835 | 0.96 | 1.53 |

Ft. Drum is currently paying for a minimum of 1.5 mgd (547,500,000 gallons per year). If Ft. Drum uses less than that amount over the period of a month, then it is charged for 1.5 mgd. If it uses more than the minimum amount, then it is charged for actual usage. Because of its telemetry system, Ft. Drum is able to closely monitor its water usage every month so it uses close to the minimum amount of the DANC water as possible. Ft. Drum currently is consuming approximately 1.94 mgd (709,300,653 gallons per year). According to telemetry system data, the DANC provides 74.6% of the water consumed at Ft. Drum. The remaining 25.4% is provided by Ft. Drum wells.

Ft. Drum personnel have requested that the water sources be analyzed to determine the optimum balance of water based on water quality, reliability, and cost.

Method of Analysis: Analysis proceeded as follows:

Water Quality: According to information from Ft. Drum personnel, the quality of the water provided from the wells at Ft. Drum is very good. The water is slightly basic and requires little chlorine treatment. Because the water is slightly basic, the chlorine may last longer in the distribution system.

The water provided by the DANC is surface water from the Black River. This water, which is more acidic, is not the quality of the well water. This water requires more chemical treatment than the well water. However, because the water is slightly acidic,

the chlorine may have better disinfectant capabilities. If the pH of the water is within 0.5 point either way of neutral (7.0), the effect on chlorine usage is probably minimal.

Reliability: The DANC is a highly reliable source of water for Ft. Drum. Even though the DANC currently provides 1.5 mgd, it is capable of providing up to 3.0 mgd.

The eleven wells at Ft. Drum are currently capable of providing approximately 2,200 gpm. In order to supplement water produced from the DANC, each well is currently operated for an average of 1,500 hours each per year. The wells are also a reliable source of water, as two of the wells are equipped with supplemental diesel engines. These engines can be used in the case of an electrical power outage.

In addition to the eleven wells currently in use, Ft. Drum has another well in reserve. The additional well has been drilled, but is not connected to the distribution system. The reserve well would require piping and electrical connections. However, well tests have indicated that this well is capable of producing up to 800 gpm.

Cost: Because the water quality and reliability of both sources is fairly equal, the most important issue in determining the optimum balance of water is cost. In order to objectively determine the optimum balance of water, the cost of Ft. Drum well water and the DANC water was analyzed at different proportions. As mentioned in Section 3.1 of this report, the cost of water at Ft. Drum is comprised of several different components:

- **Ft. Drum Electrical Costs.** Ft. Drum must pay for the electrical costs associated with operating eleven wells.
- **O&M Costs.** Maintenance charges apply to the distribution system, and are therefore assessed proportionally to both water sources. However, chemical treatment costs are applied only to the well water. The cost of treating water provided by the DANC is included in DANC's overall cost.
- **Ground Reservoir Pump Electrical Costs.** As with the O&M costs, the electrical cost incurred by the 40 hp pump which circulates water at the ground reservoir is applied proportionally to both water sources.
- **DANC Water Costs.** Ft. Drum pays a fixed fee, which includes all operational, maintenance, capital, and overhead charges incurred by the DANC and by the City of Watertown to provide water. For reasons mentioned in section 3.1.4, the capital costs are not part of the cost calculation.

The total cost of water was calculated and compared at varying proportions of water production. At one extreme, the costs were calculated based on the existing conditions, with the DANC providing 75% of the total water consumed and Ft. Drum providing the remaining 25%. At the other extreme, the cost of water was calculated with Ft.

Drum providing approximately 95% of the water demand and the DANC providing 5%. The cost analysis was based on the following assumptions:

- The total water demand for Ft. Drum was assumed to be 709,300,653 gallons per year, which is equal to the average annual demand between August 1993 and July 1995.
- It was assumed that all of the wells were operated for approximately the same number of hours each year. The independent variable in the cost analysis was the annual operating hours of each well. The costs were generally analyzed with well operating hours in 200 gpm increments (for a total of 2,200 gpm for eleven wells).
- The cost of water was analyzed based on 1995 values. The following costs were used in the analysis:
 - ◇ DANC Cost (\$0.90/kGal). The sum of the variable costs incurred by the DANC. The cost were taken from Schedule "A", provided by Ft. Drum personnel.
 - ◇ Ft. Drum Electrical Cost (\$0.072/kWh). The bundled cost of electricity, provided by the utility office at Ft. Drum.
 - ◇ Ft. Drum O&M Cost (\$20,105 per year). Ft. Drum O&M costs were provided for 1994 and 1995. This cost is based on the total costs incurred for 1995 and does not include chemical treatment costs.
 - ◇ Chemical Treatment Cost (\$5,550 per year). The chemical treatment cost for 1995 was provided by Ft. Drum personnel. It was assumed that chemical treatment costs would increase linearly as the amount of water provided by the wells increased.
 - ◇ Ground Reservoir Pump Electrical Cost (\$0.067/kGal). The cost incurred by the ground reservoir pump was based on the electrical cost necessary to circulate water through the reservoir. It was assumed that the annual operating hours required by the pump would not change because total water demand at Ft. Drum was assumed to remain constant.
- It was assumed that costs applied to both water sources would be proportioned based on the percentage of water volume supplied by each source. For example, O&M and reservoir costs are applied to both water sources. Because the total water demand does not change, the total O&M and reservoir costs will not change. However, they were proportionally charged to each water source based upon the percentage of water volume that each source provided. If the wells

were analyzed at 40% of the total water volume supplied to Ft. Drum, it incurred 40% of the total O&M and reservoir costs.

Results: Table 3-12 contains a sample of the calculations performed in the water cost analysis. The entire cost analysis is contained in Appendix D.

Table 3-12. Optimum Cost of Water

| Usage Per Well (hrs) | % of Total Flow DANC | % of Total Flow Ft. Drum Wells | Total Cost DANC (\$) | Total Cost Ft. Drum Wells (\$) | Total Cost (\$) |
|----------------------|----------------------|--------------------------------|----------------------|--------------------------------|-----------------|
| 1,500 | 75.1 | 24.9 | 0.742 | 0.081 | 0.823 |
| 2,000 | 62.8 | 37.2 | 0.616 | 0.103 | 0.719 |
| 3,000 | 44.1 | 55.9 | 0.427 | 0.138 | 0.565 |
| 4,000 | 25.5 | 74.5 | 0.238 | 0.174 | 0.412 |
| 5,000 | 6.9 | 93.1 | 0.048 | 0.210 | 0.258 |
| 5,200 | 3.1 | 96.8 | 0.010 | 0.217 | 0.227 |

Based on the results of the water cost analysis, it appears that the total cost of water consumed at Ft. Drum decreases as the amount of water produced by the wells increases. Each of the wells at Ft. Drum would be required to operate approximately 5,200 hours per year to produce the amount of water required.

To illustrate the significant cost savings that Ft. Drum could expect to see, Table 3-13 gives an annual cost of water based on a demand of 709,300,693 gallons per year. The cost savings are compared to the annual cost of \$583,755.

Table 3-13. Potential Cost Savings - Ft. Drum Water

| Well Usage (hrs) | Cost (\$/kgal) | % DANC Water | % Ft. Drum Water | Annual Cost (\$) | Annual Cost Savings (\$) |
|------------------|----------------|--------------|------------------|------------------|--------------------------|
| 1,500 | 0.823 | 75.1 | 24.9 | 583,755 | - |
| 2,000 | 0.719 | 62.8 | 37.2 | 509,987 | 73,768 |
| 3,000 | 0.565 | 44.1 | 55.9 | 400,755 | 183,000 |
| 4,000 | 0.412 | 25.5 | 74.5 | 292,232 | 291,523 |
| 5,000 | 0.258 | 6.9 | 93.1 | 183,000 | 400,755 |
| 5,200 | 0.227 | 3.1 | 96.8 | 161,011 | 422,744 |

It is probably not realistic to use Ft. Drum well water exclusively. The increased operating hours for the well pumps will increase their wear, which will produce increased operation and maintenance costs. In addition, the wells will have to be replaced sooner because of the increased operating hours. It is wise to continue to use some portion of the DANC

water as a reliable back-up source and as a source to shave the peak usage of water at the Post.

It should be noted under the current contract with the DANC, Ft. Drum is being charged for capital, O&M and overhead costs, depending upon the amount of water produced. If Ft. Drum uses more than the guaranteed 1.5 mgd in a given month, they are charged the same rate. This could infer that Ft. Drum is paying twice for capital costs once the Post's usage exceeds an average 1.5 mgd in any given month. In future contract negotiations, if possible, Ft. Drum should negotiate a lower rate for water consumption over 1.5 mgd. This rate should not include capital (fixed) costs.

If Ft. Drum is also able to negotiate a lower guaranteed water production rate from the DANC, it would produce lower annual costs.

3.5 ECO NOT RECOMMENDED

ECO 7 was not found to be economically feasible based on ECIP criteria. It is not recommended for implementation.

3.5.1 ECO 7: Reconnect Isolated Main Line

Proposed Modifications: Approximately 1,200 LF of a 12" main line located in Area 1000 near Oswego Avenue is isolated from the water distribution system. Reinstatement of this main line will allow for improved water circulation in this area.

Existing Conditions: The 1,200 LF section of 12" piping along Oswego Avenue from Leroyville Road to Tenth Street is out of commission as a result of repair work performed a few years ago. The repair work was conducted, but the line could not be properly chlorinated to allow its reinstatement into the water distribution system. This section of piping is one of six main lines that transport water from the water treatment plant to the old Post. Hydraulic and stagnation problems exist because water is forced into the other mains, thus bypassing the area directly served by the 12" main line.

Method of Analysis: Analysis proceeded as follows:

- The amount of water lost annually for the purpose of alleviating stagnation in this particular area of the water distribution system at Ft. Drum was estimated. According to the water audit performed in Section 3.3.1.5 of this report, approximately 528,000 gallons of water was lost through hydrants for the purpose of alleviating stagnation in water distribution piping or for maintenance reasons. Specific data on the number of times that the hydrants were opened in this specific area was not available. Therefore, it was assumed that 25% of the total hydrant exercises occurred specifically for the purpose of improving water

circulation in the eastern area of the old Post. Based on the assumption that 528,000 gallons of water per year was used for hydrant exercising, it was determined that approximately 132,000 gallons of water could be saved by implementing this ECO.

- A cost estimate was performed to calculate the cost of implementing this ECO. In order to properly chlorinate this line, the following construction sequence was assumed:
 - ◇ It is assumed that each end of the isolated main line is capped off. The active main line on each end would be valved off to allow the existing caps to be removed and new segments of pipe to be installed. New 12" x 6" tees would also be installed in the main line to allow for a new fire hydrant installation on each end of the isolated line.
 - ◇ A new fire hydrant would be installed on each end of the isolated main line and connected to the main line tees.
 - ◇ Once the new lines are reconnected and the new hydrants are installed, open the hydrant on both ends of the main line to flush the previously isolated main line clean.
 - ◇ Once the main line has been flushed and proper chlorine levels have been reached, open the gate valves on the both ends of the main line. The hydrants on the both ends of the main line should be closed, thus reinstating the isolated main line back into the distribution system.

The estimate included site work and mechanical costs required to connect both ends of the isolated pipe, as well the cost to connect a fire hydrant on each end.

- A Life Cycle Cost Analysis (LCCA) was performed to determine the economic feasibility of implementing this ECO. Cost savings was based upon the estimated quantity of water saved from hydrant exercising in order to alleviate stagnation problems in this particular area.

Results: Table 3-14 below summarizes the economic analysis. The LCCA, cost estimate, and calculation of total leakage savings can be found in Appendix D.

Table 3-14. ECO 7 Economic Analysis

| | |
|----------------------------------|----------|
| Total Investment | \$11,333 |
| Annual Water Savings (kgal/year) | 132 |
| Annual Cost Savings | \$109 |
| Total Discounted Cost Savings | \$1,465 |
| Simple Payback (years) | 104.32 |
| Savings-to Investment Ratio | 0.13 |

FEMP funding qualifications require an ECO candidate to have a simple payback of 10 years or less and an SIR of 1.25 or better. This particular project does not qualify for government funding.

4. SUMMARY AND RECOMMENDATIONS

4.1 SUMMARY OF THE WATER DISTRIBUTION SYSTEM

According to the data accumulated from the field survey and the leak detection survey, the following were noted:

- The domestic water system at Ft. Drum uses an average of 709,300,653 gallons of water per year, which translates to a daily rate of approximately 1.94 million gallons.
- The estimated leakage discovered by the leak detection survey was 187,000 gpd (68,255,000 gallons per year or 9.6% of the total water produced). However, leakage amounting to 18,000 gpd was eliminated once thirteen fire hydrants and one valve were completely sealed by the leak detection crew. Therefore, a total of 169,000 gpd (61,685,000 gallons per year) was identified as leakage, which translates into approximately 8.7% of the total usage.
- The estimated audit value for annual recoverable leakage was calculated to be 62,620,615 gallons per year, or nearly 8.8% of the total usage.

The estimated audit value is a baseline or "minimum expected" leakage rate. The estimated leakage discovered is the actual estimated leakage rate. Given this information, it should be noted that the results of ECO 5 show a favorable economic payback while using the slightly higher leakage amount estimated by the water audit.

4.2 SUMMARY OF ENERGY AUDIT

According to the Scope of Work, ECIP criteria is to be used to categorize ECOs. In order to qualify for government funding programs, the ECOs must have a simple payback of 10 years or less and a SIR of 1.25 or greater. For this study, eight ECOs were investigated. Table 4-1 on the following page summarizes the ECOs investigated in this study.

Table 4-1. Summary of ECOs

| ECO No. | Description | Investment Cost (\$) | Annual Water Savings* | Total Discounted Savings (\$) | SIR | Payback (yrs) |
|---------|-----------------------------|----------------------|-----------------------|-------------------------------|--------|---------------|
| 1 | Repair Main Line Leaks | 2,612 | 56,210 | 623,681 | 238.82 | 0.06 |
| 2 | Repair Valve Leaks | 927 | 730 | 8,100 | 8.74 | 1.54 |
| 3 | Repair Fire Hydrant Leaks | 35,908 | 4,745 | 52,648 | 1.47 | 9.20 |
| 4 | Repair All Leaks | 39,447 | 61,685 | 684,430 | 17.35 | 0.78 |
| 5 | Implement Leak Detection | 29,120 | 62,621 | 302,564 | 10.39 | 1.30 |
| 6 | Connect Valve Pit Actuators | 3,247 | 396 | 4,394 | 1.35 | 9.96 |
| 7 | Reconnect Isolated Main | 11,333 | 132 | 1,465 | 0.13 | 104.32 |
| 8 | Optimize Ft. Drum vs. DANC | - | - | - | - | - |

*Annual Water Savings are in units of thousands of gallons saved per year

4.3 RECOMMENDATIONS

It is recommended that the qualifying ECOs for government funding programs be implemented. A summary of the recommended ECOs is listed in Table 4-2 below.

Table 4-2. Recommended ECOs

| ECO No. | Description | Investment Cost (\$) | Annual Water Savings* | Total Discounted Savings (\$) | SIR | Payback (yrs) |
|---------|-----------------------------|----------------------|-----------------------|-------------------------------|-------|---------------|
| 4 | Repair All Leaks | 39,447 | 61,685 | 684,430 | 17.35 | 0.78 |
| 5 | Implement Leak Detection | 29,120 | 62,621 | 302,564 | 10.39 | 1.30 |
| 6 | Connect Valve Pit Actuators | 3,247 | 396 | 4,394 | 1.35 | 9.96 |
| 8 | Optimize Ft. Drum vs. DANC | - | - | - | - | - |

*Annual Water Savings are in units of thousands of gallons saved per year

- **ECO 4.** Replace the main line, valves, and fire hydrants identified as having leaks by the leak detection survey. ECO 4 is a combination of ECOs 1 through 3. Although each of those ECOs are economically feasible based upon their own merits, combining them would simplify the programming documentation and produce a better project.

Note that some of the leaks may have been repaired by maintenance personnel at the time they were discovered by the leak detection survey. Coordination with maintenance personnel will be required to determine which leaks are still in need of repair.

- **ECO 5.** According to the guidelines set by AWWA Manual 36, a leak detection survey should be performed annually. An aggressive leak detection program

should produce a decrease in the amount of leakage. The water audit showed that the benefits of performing a leak detection survey and repairing the leaks that are discovered will outweigh the costs of the survey.

- ECO 6. Connect the water valve actuators in Valve Pit #4 to the telemetry system. Providing automatic control to the valves will allow flow to be alternated between the 16" and 20" main lines that join the old and new Posts. Increased flow through Valve Vault #4 (16" line) should improve water circulation on the western side of the old Post.
- ECO 8. Water consumed at Ft. Drum comes from two sources. Water provided by the DANC makes up approximately 75% of the total, while wells at Ft. Drum supply the remaining 25%. Ft. Drum currently pays \$0.82 per thousand gallons of water, which accounts for water produced from both sources (except for fixed costs charged by the DANC). Under an agreement, DANC provides a minimum of 1.5 mgd at a fixed cost according to a schedule provided by Ft. Drum personnel (In 1995, the cost was \$6.25/kgal. In 1997, after DANC capital costs are paid in full, the cost is estimated to be \$1.49/kgal.).

The total cost of water from both sources was based on a combination of electrical costs, O&M costs, chemical treatment costs, and water storage costs. Calculations show that the total cost of the water produced by both sources decreases as more well water is produced and less DANC water is used. The cost of water if Ft. Drum supplies 75% of the total water consumed was calculated to be \$0.41 per kGal. The cost of water if Ft. Drum supplies 95% of the total was calculated to be about \$0.24 per kGal.

It is reasonable to maintain an equitable balance between Ft. Drum well water and water supplied by the DANC. If Ft. Drum is able to negotiate a lower guaranteed water production rate from the DANC, it would produce lower annual costs.

In accordance with the SOW, Ft. Drum personnel provided direction regarding the combination of ECOs into projects. They requested that all appropriate ECOs be combined into one project. To be considered appropriate, the synergistic effects of the bundled ECOs must meet government funding criteria with an SIR of 1.25 and a simple payback of 10 years or less. Programming documentation has been prepared for ECOs 4, 5, 6, and 7. The results of the economic analysis for the bundled project are listed in Table 4-3 below.

Table 4-3. Economic Analysis for Bundled Project

| | |
|----------------------------------|-----------|
| Total Investment | \$83,148 |
| Annual Water Savings (kgal/year) | 124,834 |
| Annual Cost Savings | \$73,618 |
| Total Discounted Cost Savings | \$992,857 |
| Simple Payback (years) | 1.13 |
| Savings-to-Investment Ratio | 11.94 |

The programming documentation and backup calculations can be found in Appendix E.

5. REFERENCES

AWWA Manual 36, Water Audits and Leak Detection, American Water Works Association, Denver, CO, 1990.

AWWA Research Foundation, Assessment of Existing and Development of Water Main Rehabilitation Practices, American Water Works Association, Denver, CO, 1990.

AWWA Research Foundation, Water Main Evaluation for Rehabilitation/Replacement, American Water Works Association, Denver, CO, 1986.

Walski, Thomas M., Ph.D., P.E., Analysis of Water Distribution Systems, Van Nostrand Reinhold Company Inc., 1984.

APPENDIX A

SCOPE OF WORK AND CONFIRMATION NOTICES

**Scope of Work
Confirmation Notices
Mission Statement**

**SCOPE OF WORK
FY 95 POTABLE WATER CONSERVATION STUDY
FOR
FORT DRUM, NEW YORK**

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1. BRIEF DESCRIPTION OF WORK: The Architect Engineer (AE) shall:

1.1 Perform a site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.

1.2 Evaluate specific ECOs to determine their energy savings potential and economic feasibility.

1.3 Provide project documentation for recommended ECOs as detailed herein.

1.4 Prepare a comprehensive report to document all work performed, the results and all recommendations.

2. GENERAL

2.1 This Study is limited to the evaluation of the specific buildings, systems, or ECOs listed in APPENDIX A, DETAILED SCOPE OF WORK.

2.2 The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

2.3 For the buildings, systems or ECOs listed in APPENDIX A, DETAILED SCOPE OF WORK,, all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered unfeasible shall also be documented in the report with reasons for elimination.

2.4 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 Jan 1994 establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. The Program Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.

2.5 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP, or O&M funding, and determining in coordination with installation personnel the appropriate packaging and implementation approach for all feasible ECOs.

2.5.1 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.5.2 All feasible Non-ECIP projects shall be ranked in order of highest to lowest SIR.

2.5.3 At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. The Director of Public Works will indicate which program is used at this installation. This Scope of Work mentions only ECIP, however, ECAM is also meant.

3. PROJECT MANAGEMENT

3.1 Project Managers. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall immediately be designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative

3.2 Installation Assistance. The Commanding Officer or authorized representative at the installation will designate an individual to assist the AE in obtaining information and establishing contacts necessary to accomplish the work required under this contract. This individual will be the installation representative

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE's project manager and the Government's representative shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Public Works before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance

3.7.1 Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

- ♦ Schedules
- ♦ Names of energy analysts who will be conducting the site survey
- ♦ Proposed working hours
- ♦ Support requirements from the Director of Public Works

3.7.2 Exit. The exit interview shall briefly describe the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Public Works.

4. **SERVICES AND MATERIALS.** All services, materials (except those specifically enumerated to be furnished by the Government), labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. **PROJECT DOCUMENTATION.** All energy conservation opportunities which the AE has considered shall be included in one of the following categories and presented in the report as such.

5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than \$300,000, a Savings to Investment Ratio greater than 1.25 and a simple playback period of less than ten years. For ECAM projects, the \$300,000 limitation may not apply in such cases, the AE shall check with the installation for guidance. The

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overall project and each discrete part of the project shall have an SIR greater than 1.25. All projects meeting the above criteria shall be arranged as specified in paragraph 2.6.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure(PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs

5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate or pay back period, but which have a SIR greater than 1.25 shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.5.2 and shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, i.e., energy savings calculations and cost estimate(s), and the simple play back period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

5.2.1. O & M Energy Projects: An O&M Energy project is one that results in needed maintenance or repair to an existing facility, or replaces a failed or failing existing facility, and also results in energy savings. The criteria are similar to the criteria for ECIP projects, i.e., \$300,000 construction cost, $SIR \geq 1.25$, and simple play back period of less than ten years. In addition, if the project would replace a system or equipment that is considered failed or failing' due solely to obsolete technology or inefficiency, the equipment to be replaced must have been in use for at least three years; and the simple play back period must be three years or less.

5.2.2. Low Cost/No Cost Projects. These are projects which the Director of Public Works (DPW) can perform using his resources. Documentation shall be as required by the DPW.

5.3 Non-feasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The Detailed Scope of Work is contained in APPENDIX A, DETAILED SCOPE OF WORK,.

7. WORK TO BE ACCOMPLISHED.

7.1 Perform A Site survey. The AE shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. The AE shall document his site

survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report.

7.2 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in APPENDIX A, DETAILED SCOPE OF WORK. These ECOs shall be analyzed in detail to determine their feasibility. Savings to Investment Ratios (SIRS) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions and engineering equations shall be clearly stated. Calculations shall be prepared showing how all numbers in the CEO were figured. Calculations shall be an orderly step by step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. Construction cost estimates shall be provided and shall break out the costs associated with rehab work (architectural, electrical, mechanical) where applicable. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.

7.3 Combine ECOs Into Recommended Projects. During the Interim Review Conference, as outlined in paragraph 7.4.1, the AE will be advised of the DPW's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per par 7.4.2.

7.4 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included. The AE shall give a formal presentation of the interim submittal to installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. It is anticipated that the presentation and review conference will require approximately one working day. The presentation and review conference will be at the installation on the date agreeable to the Director of Public Works, the AE and the Government's representative. The Contracting Officer may require a re-submittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.4.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple play back period of all the ECOs shall be included. The results of the ECO analyses shall be summarized by lists as follows:

7.4.1.a. All ECOs eliminated from consideration shall be grouped into one listing with reasons for their elimination as discussed in par 5.3.

7.4.1.b. All ECOs which were analyzed shall be grouped into two listings, recommended and non-recommended, each arranged in order of descending SIR. These lists may be subdivided by building or areas appropriate for the study. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. At the Interim Submittal and Review Conference, the Government's and AE's representatives shall coordinate with the Director of Public Works to provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this Study shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three ring binder which will allow repeated disassembly and re-assembly of the material contained within.

7.4.2 Final Submittal. The AE shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The AE shall submit the Scope of Work for the study and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The lists of ECOs specified in paragraph 7.4.1 shall be included for continuity. The final report and all appendices shall be bound in standard three ring binders which will allow repeated disassembly and re-assembly. The final report shall be arranged to include:

7.4.2.a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See APPENDIX B, EXECUTIVE SUMMARY GUIDELINE, for minimum requirements).

7.4.2.b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.

7.4.2.c. Documentation for the recommended projects.

1) Backup information as specified in par 5.1.

7.4.2.d. Appendices to include as a minimum:

- 1) Energy cost development and backup data
- 2) Detailed calculations
- 3) Cost estimates
- 4) Computer printouts (where applicable)
- 5) Scope of Work

**APPENDIX A
DETAILED SCOPE OF WORK,
FY95 POTABLE WATER CONSERVATION STUDY
FORT DRUM, NEW YORK**

1. All facilities to be investigated in this Study are located at Fort Drum, New York
2. The General Scope of Work outlines requirements for the Study and the Report; and the detailed scope of work lists the specific areas to be studied. If any conflicts arise between the General and the Detailed scopes of work, the Detailed Scope of Work shall govern.
3. The work consists of identifying and evaluating energy conservation opportunities (ECOs) for post wide Potable Water System. A list of suggested ECOs is provided in APPENDIX D, POTABLE WATER SYSTEM ECOS. The ECOS in APPENDIX D, are to be evaluated as applicable for the area or facilities listed in APPENDIX D, LIST OF AREAS/FACILITIES TO BE STUDIED.
4. Completion and Payment Schedule: The following schedule shall be used as a guide in approving payments on this contract. The Contracting Officer's Representative (COR) will be Mr. Bryant Wilkins at the Norfolk District, COE

| | |
|---------------------|---|
| Interim Submittal | 135 Calendar Days after Notice to Proceed |
| Pre-Final Submittal | 150 Calendar Days after Notice to Proceed |
| Final Submittal | 180 Calendar Days after Notice to Proceed |

| MILESTONE | PERCENT OF CONTRACT AMOUNT AUTHORIZED FOR PAYMENT |
|---|--|
| Entry Interview | 10 |
| Completion of Field Work | 50 |
| Receipt of Interim Submittal | 75 |
| Completion of Interim Presentation & Review | 85 |
| Receipt of Final Submittal | 100 |

5. The installation representative for this contract will be Mr. Joe Ogiba Utilities Branch, Directorate of Public Works , FORT DRUM, New York. (315) 772-3322 FAX (315) 772-9613.
6. Government Furnished Information: The following documents are available for the use of the AE.
 - ♦ As built drawings (as available) of buildings/systems
 - ♦ Architectural and Engineering Instructions, Design Criteria, dated 9 December 1991, Revised 8 July 1992.
 - ♦ TM5-785 Engineering Weather Data.

- ◆ AR5-4, Change No.1, dated 1 August 1982, Department of the Army Productivity Improvement Program.
- ◆ Energy Conservation Investment Program (ECIP) Guidance, dated 10 January 1994.
- ◆ AR415-15, dated 1 January 1994, Military Construction, Army (MCA) Program Development.
- ◆ Tri-Service Military Construction Program (MCP) Index, dated February 1991 for Cost Estimating

7. Direct Distribution of Submittals: The AE shall make direct distribution of correspondence, minutes, report submittals, and responses to comments as indicated by the following schedule:

AGENCY

CORRESPONDENCE

EXECUTIVE SUMMARIES

REPORTS

FIELD NOTES

Commander
10th Mountain Division (LD) and Ft. Drum
85 First Street West
Fort Drum, NY 13603-5097
Attn: AFZS-EH-OM, Mr. Joe Ogiba

1 3 3 1*

Commander
U. S. Army Engineer District, Norfolk
ATTN: CENAO-EN-MP (Mr Mlecik)
803 Front Street
Norfolk, VA 23510

1 3 3 1*

Commander
USAED, North Atlantic
ATTN: CENAD-EN-MM (Mr Wong)
90 Church Street
New York, NY 10007

- 1 1 -

Commander
 USAED, Mobile
 ATTN: CESAM-EN-DM (Battaglia)
 PO Box 2288; Mobile, AL 36628-0001

1 1 1

Commander
 US Army Corps of Engineers
 ATTN: CEMP-ET (Mr Gentil)
 20 Massachusetts Avenue NW
 Washington, DC, 20314 - 1000

1
 (Final Only)

Headquarters, Forces Command
 Attn: FCEN-RDF, Mr. Naresh Kapur
 Energy Office, Building 200
 Ft. McPherson, GA 30330-6000

1
 (Final Only)

* Field Notes submitted in final form at interim submittal.

Progress reports will be prepared on a monthly basis to highlight the significant events of the prior month. This is especially true of actions completed, problems discovered, schedule changes and ECO developments. The progress reports will accompany monthly billings and will form the basis for progress meetings.

8. A computer program titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The AE is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 333-3977 or (800) 842-5278.

9. METHOD

9.1 INVESTIGATION OF EXISTING CONDITIONS

The Contractor will collect information on the existing Potable Water system (approximately 129 miles of pipe) and operations so as to have a reasonable understanding of operations, costs, energy use, problems, limitations, future needs, etc. This will be accomplished in the following steps.

Data Gathering. The Contractor will collect available data that will assist in energy use evaluations and recommendations. A partial list of data that will be sought are:

Energy bills and summaries

- Prior studies and energy reports (if any)
- Schedules
- Piping drawings
- Site plans
- Maintenance records
- Copies of other drawings needed
- Proposals from vendors or contractors
- Potable Water plant operator logs

Site Visits, Inspections. The AE shall perform a site survey of the existing Potable Water System and perform a through survey using state of the art underground leak detection equipment such as infrared and tracer gas on all water mains and branches but not including service lines to individual buildings to determine existing conditions and areas of containment system degradation.. The AE shall also obtain a copy of any prior infrared surveys. Refer to Appendix E for detailed requirements of the leak detection survey.

The AE shall confer with DPW personnel to determine operating conditions and planned projects which affect the system.

Nameplate data will be collected as well as observations of arrangements, physical condition and effectiveness. The following measurements will be normally collected:

- Electrical loads, voltage, amperage, kVA, and P.F.
- Potable Water flow rates
- Schedules (where possible)
- Dimensions

Photographs will be taken of key areas for later reference.

ANALYSIS OF SYSTEMS

The Contractor will utilize standard methods of engineering calculations to understand current energy consumption in such detail as to permit identification of further improvement options.

POTABLE WATER SURVEY

Process water system maps for Fort Drum shall be developed showing the location and estimated flow of the leaks. The resulting maps shall be compared with Fort Drum's current mission, and a decision shall be made by Fort Drum DPW whether to repair, replace or isolate faulty piping sections. The Contractor shall confer with Fort Drum DPW and agree upon projects to develop for the water piping upgrades. The energy savings resulting from these projects will include reduced pumping costs, water treatment costs, annual repair costs where piping is replaced or isolated, and any other savings resulting from reduced water consumption.

The AE shall review information collected during the field survey to evaluate modifications currently being made to the cathodic protection system to determine if the modifications will eliminate the Potable Water containment system deterioration. The AE shall also evaluate potential modifications which will correct existing Potable Water containment system deficiencies.

The AE shall estimate the cost of modifications to correct the continuing deterioration of the Potable Water containment system and the cost to repair existing deficiencies. The AE shall estimate energy savings and perform an LCCA for each modification considered.

The analysis will also consider Potable Water loads that are expected to increase or reduce in the future due to changes in facility use, change of mission, new additions, etc.

Other Miscellaneous Uses and Losses. The study will also consider costs and energy usage related to other Potable Water usage not discussed above. Each miscellaneous use may include cost of water, pumping costs, chemical treatment, etc.

Utility Rate Analysis. A separate calculation will be performed for each type of energy conserved - gas, oil, and electric. The incremental cost of fuel will be used for all energy savings options.

ENERGY CONSERVATION OPPORTUNITY INVESTIGATIONS

The Contractor will investigate all reasonable options of saving energy and energy-related costs in the operation of the Potable Water production and distribution systems. The approach used to identify each option is briefly described below.

Existing Conditions. This section describes the nature of the existing operating system, its energy use, costs, advantages and disadvantages. Data is usually transferred to this section from the calculations.

Energy Conservation Opportunities. This section describes improvement ideas that are different from the existing conditions. They may describe a capital projects, modifications, or O&M procedures. The resulting improvements are described, energy costs, quantities and arrangements are briefly noted. Sufficient conceptual studies will be executed to determine feasibility, generate anticipated operational data and estimating values.

Construction Cost Estimate. A feasibility cost estimate in the format prescribed will be performed. The estimate breakdown will be included in the report showing known quantities and costs. Allowances for indirect costs and contingencies are included.

Annual Savings. The report will show the annual savings in energy, quantities, demand, costs, and BTU's. As the report is written, these savings are merely the difference between existing and proposed.

Discussion. This section of the report describes a number of relevant factors including payback period, impact on labor or non-energy costs, O&M concerns, appearances, comfort, life extension, etc. The intent of this section is to address normal impacts or uncertainties of various improvement ideas.

REPORT PREPARATION PHASE

The Contractor will prepare an Energy Analysis report which will fully document the steps previously described. The report will be prepared as follows.

Executive Summary - Section 1. The outline of the executive section is shown on Appendix B.

Methodology - Section 2. This part of the report describes the approach, sequence, assumptions, calculations methods, computer programs, sample outputs, etc. that were used for the study.

Facility Description - Section 3. The report will briefly discuss the buildings and systems covered by the study. It will show floor plans, layout flow diagrams, facility age and condition, major equipment characteristics by system, hours of operation, and concerns expressed by occupants and managers.

Energy Use and Costs - Section 4. The report will describe individual and combined energy consumption for the past two years. The report will describe rate structures, incremental cost calculations, trends, and analysis of use by source. This section critically establishes baseline use of energy for later improvement possibilities.

ECOs Recommended - Section 5. This section describes in detail each of the Energy Conservation Opportunities (ECOs) that are recommended for adoption and funding. The approach to each ECO write-up is described in Section 5, Project Documentation

ECOs Not Recommended - Section 6. The report will also show ECOs that were investigated but not recommended for adoption due to economics, conflicts, with other ECOs or concerns of operations.

Discussion - Section 7. This part of the report will cover interesting findings of the study not related to other sections of the report. It may include recommendations for non-energy problems, further studies, O&M procedures, training, etc.

Attachments. As part of the report, there will be enclosures for photos, backup calculations, referenced materials such as rate tariffs, codes, etc.

Applications and Funding Requests. As part of this study, applications for project funding will be made in accordance with Section 5, Project Documentation and directions from local authorized persons. The exact level of funding and funding program (expected to be ECIP), will be at the direction of the facility manager.

Suggested Implementation Schedules. The report will also contain a suggested timetable for implementing various projects or programs. This recommendation will be made in consultation with various facility managers.

Operation and Maintenance Instructions. Where appropriate, the study will recommend the formation of procedures or changes to processes that relate to improved energy usage and costs through Operation and Maintenance.

APPENDIX B
EXECUTIVE SUMMARY GUIDELINE,

1. Introduction.
2. Building Data (types, number of similar buildings, sizes etc.)
3. Present Energy Consumption of Buildings or Systems Studied.
 - ◆ Total Annual Energy Used.
 - ◆ Source Energy Consumption.
 - Electricity KWH, Dollars, BTU
 - Fuel Oil GALS, Dollars, BTU
 - Natural Gas THERMS, Dollars, BTU
 - Propane GALS, Dollars, BTU
 - Other QTY, Dollars, BTU
4. Reevaluated Projects Results.
5. Energy Conservation Analysis.
 - ◆ ECOs Investigated.
 - ◆ ECOs Recommended.
 - ◆ ECOs Rejected. (Provide economics or reasons)
 - ◆ ECIP Projects Developed. (Provide list)*
 - ◆ Non-ECIP Projects Developed. (Provide list)*
 - ◆ Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet; the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple pay back period and the analysis date.
6. Energy and Cost Savings.
 - ◆ Total Potential Energy and Cost Savings.
 - ◆ Percentage of Energy Conserved.
 - ◆ Energy Use and Cost Before and After the Energy Conservation opportunities are Implemented.

APPENDIX C,
REQUIRED FORM DD1391 DATA,

To facilitate ECIP project approval, the following supplemental data shall be provided:

1. In title block clearly identify projects as "ECIP."
2. Complete description of each item of work to be accomplished including quantity, square footage, etc.
3. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).
4. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.
 - 4.1. If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.
 - 4.2. Identify weather data source.
 - 4.3. Identify infiltration assumptions before and after improvements
 - 4.4. Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.
5. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.
6. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.
7. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period

8. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

9. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10 year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and (3) an economic analysis supporting the specific retrofit.

10. Non-appropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

11. Any requirements required by ECIP guidance dated 10 Jan 1994 and any revisions thereto. Note that non-escalated costs and savings are to be used in the economic analyses.

12. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

APPENDIX D
POTABLE WATER ECOS

Energy Savings Opportunities include but are not necessarily limited to:

- Replacement of failed elements of POTABLE WATER distribution system
- Isolation of branches of the POTABLE WATER system
- Prevention of further degradation of the POTABLE WATER distribution system.
- Examination of ongoing cathodic protection program
- Reduction of flushing costs due to stagnant lines.

LIST OF AREAS/FACILITIES TO BE STUDIED,

This study will include a thorough understanding of recommended improvements to the following:

Potable Water Distribution system from the central plant to other buildings served by the system including piping, insulation, valves, controls, and associated structures.

Facilities which currently or will potentially utilize the Potable Water



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Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 1

EMC #1406-012

DATE: 3 November 1995

PROJECT: Ft. Drum Water Conservation Study
CONTRACT NO.: DACA01-94-D-0033, D.O. No. 12

NOTES: Michael Scholz and Tom Poeling
PREPARED BY: E M C Engineers, Inc.

DATE OF MEETING: 24 October 1995

PLACE OF MEETING: Building 4000, Ft. Drum
Watertown, NY

SUBJECT: Kick-off Meeting Notes

ATTENDEES: Steve Rowley, Energy Manager, Ft. Drum
Joe Ogiba, Telemetry System Manager, Ft. Drum
Gregory Engel, M.E. Simpson, Inc.
Mike Simpson, M.E. Simpson, Inc.
Bill Center, EMC Engineers, Inc.
Michael Scholz, EMC Engineers, Inc.
Thomas Poeling, EMC Engineers, Inc.

The following is a summary of the items discussed, the comments made, and the decisions made during the kick-off meeting conference.

The meeting began with an overview of the work to be performed for the water study. The study will consist of the following main elements:

- **Leak Detection Survey and Site Audit.** A leak detection survey will be performed by M.E. Simpson, Co.. M.E. Simpson will use a combination of listening devices and preamplified-transducer systems to identify leak locations. When the location of the leak can not be readily identified using these methods, a leak correlator will be used.

E M C Engineers, Inc. will perform a site audit on the existing potable water distribution system. The audit will include tasks such as interviewing post personnel to gain an understanding of the

current system operation and past history, gathering data relevant to water consumption and electrical usage, and identifying possible energy conservation projects in the water system.

- **Economic Analysis.** Specific energy conservation opportunities (ECOs) will be evaluated to determine their economic feasibility. ECOs will be evaluated based on current Energy Conservation Investment Program (ECIP) criteria, according to the scope of work. Analysis will include cost estimates and a Life Cycle Cost Analysis (LCCA) for each ECO.
- **Interim Submittal.** Results of the leak detection survey and the economic analysis will be submitted in the form of an interim submittal report.
- **Final Submittal.** Comments from government agencies on the interim submittal will be incorporated into a final report. Programming documentation for economically feasible projects will also be included.

Mr. Simpson presented a brief overview of the leak detection survey, as described above. Mr. Simpson anticipates that his crew will be on site until approximately 10 November. Mr. Rowley states that there are no restricted areas on post except for those areas within fences. The M.E. Simpson crew should contact Post personnel for access. Mr. Rowley will notify the provost by letter regarding the water study; Building T-213 will be made available for M.E. Simpson's use, if required.

The water distribution system at Ft. Drum is close in many locations to High Temperature Hot Water (HTHW) piping. Mr. Simpson was asked whether pipes buried within close proximity to the water distribution system could produce incorrect leak sounds in the detection equipment. Mr. Simpson replied that he personally has only experienced an incorrect leak sound once, and the pipe was physically touching the water distribution pipe.

Mr. Simpson was asked to explain his method for estimating the quantity of leakage. He replied that the best way to estimate leakage is to excavate the leak for visual inspection. The quantity of leakage is based on several factors, including the type and size of pipe, water pressure, and physical size of the leak. When the leak is not excavated, experience is the best tool to estimate leakage rate.

Mr. Center discusses the fact of cathodic protection evaluation being written as part of the scope was included in error and is not a part of the scope of work for this project. Mr. Rowley concurs.

The scope of work involves the investigation of an estimated 129 miles of water distribution piping. The investigation will include both the old and new Post. The new Post is 6-8 years old, the old Post was constructed between 1941-1942. The water distribution system is constructed primarily of ductile iron main lines, with branch lines made of ductile iron and PVC (especially in the housing areas). Original piping for the old Post was constructed of transite (asbestos cement) piping. A project was performed several years ago to replace the majority of transite piping with ductile iron. In most cases, the transite piping was abandoned in place.

Water is provided to Ft. Drum from two major sources:

Confirmation Notice No. 1

3 November 1995

Page 3 of 5

- Eleven active water wells, located mainly east of the old Post, which are capable of providing 2,200 gpm. The quality of the water from the wells is very good. Well No. 1 is a twelfth well presently not operating and has not been utilized for a few years.
- DANC (Development Authority of North Country) provides Ft. Drum with water to supplement their system. By contract, Ft. Drum purchases 1.5 MGD. This is a negotiated quantity and has been reduced from previous levels. The flow rate is an average of 2400 gpm to 4800 gpm. The DANC facility is about 4 years old. The water from DANC originates as surface water from the Black River, is treated and pumped to an above ground storage tank at Ft. Drum.

The water system has more than adequate storage and capacity for Ft. Drum's water demand. The system is comprised of the following components:

- Three elevated tanks, No. 1, 2 and 3. Tank No. 1 (250,000 gallons) supplies water to the old Post. Tank No. 2 (250,000 gallons) is currently not being used due to low demand for water in the old Post. Tank No. 3 (1 MG) supplies water to the new Post.
- A 750,000 gallon ground water storage facility. This reservoir is served by two pumps. A 40 hp pump is used to maintain reservoir volume and a 75 hp pump is used only for emergency fire demand.
- Chlorine is injected at the water treatment plant. The water has 1.5 ppm free chlorine at water plant. At the sewage treatment plant, the site furthest from the water plant, the chlorine level is normally measured at 0.2 to 0.4 ppm.
- The maximum pressure in the old Post is 90 psi, and 130 psi in new post. Minimum pressure expected in the new Post is approximately 30 psi.

The water distribution system is monitored and controlled by a Bristol-Babcock telemetry system, which was installed approximately three years ago. Nine remote units and a master unit provide an electronic interface with various components within the water system.

The system has the capability to:

- Monitor and control water tank levels.
- Provide manual or automatic control for all eleven operating wells. The telemetry system automatically operates and sequences each well based on elevated tank water elevation and the operating hours for each well. One well is operated continuously to allow chlorine to be injected into the water system at all times. Wells with the fewest operating hours are turned on first. Wells with the most operating hours are the first to be turned off.
- Monitor and control chlorine injection into the system.

- Operate during power outages. The control units located in the plumbing shop and the water treatment plant are each equipped with a 20 hour UPS.
- Provide over three years of historical data regarding equipment and operations in the water distribution system. Appropriate information regarding historical water usage from specific meters will be provided to EMC.

This water study will propose projects that will improve Ft. Drum's water system. Justification for the projects will be based on energy savings and economic payback according to the ECIP guidelines. Mr. Rowley related that it was his intention to request funding from the Federal Energy Management Program (FEMP) program. FEMP has a separate category for water conservation studies that does not offer as stringent requirements for acceptance as typical energy projects.

Several energy conservation programs were identified, including:

- Location and remediation of leaks throughout the distribution system, including main line, valve, and hydrant leaks.
- Remediation of water stagnation problems, which is evidenced by low chlorine residual measurements. Low chlorine is not only relegated to dead end lines. There are areas in the old Post which are subject to low water usage and have low chlorine content. The installation of recirculation pumps or additional looped water lines to improve water flow circulation was suggested as possible solutions.
- Isolation of branches of the potable water system. Areas of low water demand which exhibit high leakage levels may be isolated from the system. Isolation of specific areas would have to be approved by the appropriate fire safety authorities.
- Upgrade of telemetering system. Additional remote monitoring units may assist Ft. Drum personnel in determining the source of recoverable leakage by decreasing the amount of unknown water users on Post.
- Water audit and leak detection program. The water audit will include identification of all known water users on Post and an estimation of the amount of water used. The amount of known water used subtracted from the total amount of water pumped would result in unknown water usage. AWWA allows auditors to assume that 75% of the unknown water is leakage that can be recovered.

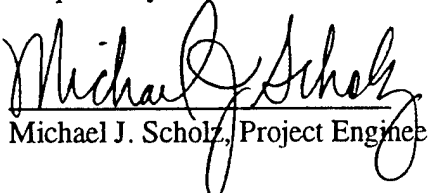
Confirmation Notice No. 1
3 November 1995
Page 5 of 5

The submittal schedule for this project will be as proposed below with a slight change from Scope of Work to include an interim submittal review conference and revised final submittal date.

- Notice to Proceed: 16 October 1995
- Interim Submittal: 28 February 1996
- Interim Submittal Review Conference: 30 March 1996
- Final Submittal: 30 April 1996 (or 30 days after Interim Submittal Review Conference)

This meeting was adjourned.

Respectfully submitted,

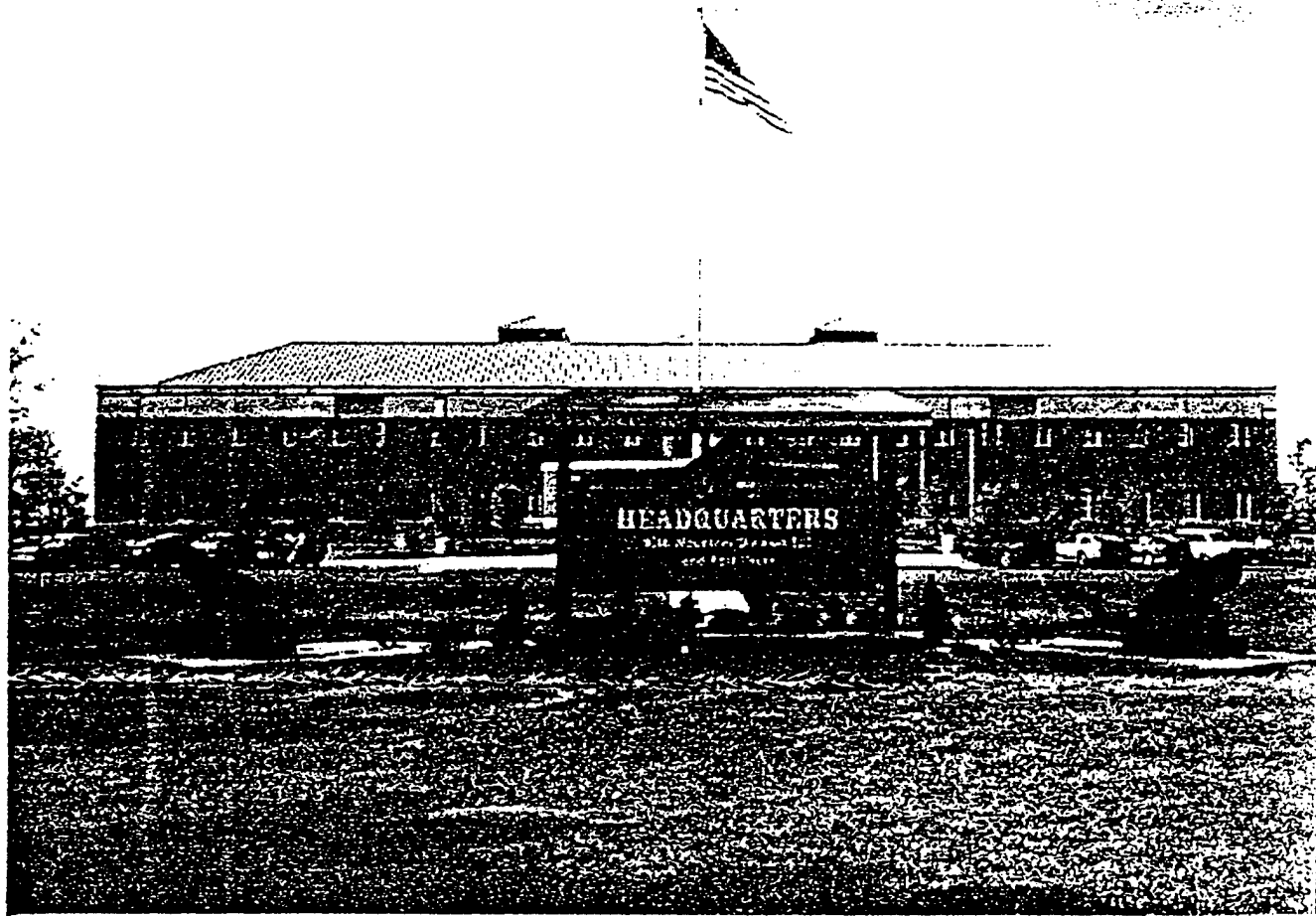

Michael J. Scholz, Project Engineer

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cc: Attendees
Tony Battaglia, COE Mobile
Doug Gray, EMC
Dennis Jones, EMC

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

10th Mountain Division (LI)
and
Fort Drum



Total Army Quality Self Assessment

1995

OVERVIEW

INTRODUCTION AND HISTORY

Fort Drum is a FORSCOM Army installation located in northern New York. As a major training and mobilization center for all branches of the Total Army, it is the largest Army Installation in the Northeast, and the only all-weather training base in the continental United States. In 1908, National Guard soldiers from the New England states began training on 10,000 acres of land leased from the Greater Watertown Chamber of Commerce.

The War Department purchased the land the following year and named it Pine Plains after the abundance of pine trees which covered the area. Major expansion took place just prior to World War II. Pine Plains, renamed Pine Camp, was designated as a training post to develop armored divisions. Three divisions trained here: the 4th Armored Division, the 5th Armored Division, and the 45th Infantry Division. The wooden cantonment area, basically completed in 1941, was large enough to house one division. In 1951, Pine Camp was designated Camp Drum, in memory of Lieutenant General Hugh A. Drum, a First Army Commander during World War II.

As an indicator of the importance Camp Drum plays in the Total Army, it was designated Fort Drum in 1974. In September 1984, the Department of Army announced that Fort Drum would be the home of the reactivated 10th Mountain Division (Light Infantry). In addition to the Division, Fort Drum is also a major training site for Reserve Components and host to 26 Tenant organizations.

MISSION

The mission of the Fort Drum Garrison is to:

Command, operate, manage and administer the use of resources to accomplish all assigned missions. Additionally, the garrison provides administrative, logistical and management support to assigned or attached tenant units and activities to include both on-post and off-post units or activities in the assigned geographic area.

VISION

Fort Drum has fully embraced the Total Army Quality concepts over the past 4 years and the recently developed Total Army Quality Performance Improvement Criteria. Fort Drum's Garrison Commander, Colonel Joel E. Williamson, has taken a personal interest in this program and has worked with his staff and many others at the installation to develop the Garrison Quality Vision Statement which follows:

Provide a highly effective, efficient, customer-focused, service oriented installation where all soldiers, civilian employees and families live, work, and train with the full support of the North Country Community. Continuously look for ways to improve processes and procedures that will result in improved readiness, service, support, and quality of life, enabling Fort Drum to remain viable into the 21st Century.

PRODUCTS AND SERVICES

The support services provided by the Fort Drum Garrison can be divided into three major areas. The first area consist of those services which directly support the development of Combat Ready Soldiers who must be able to mobilize and deploy within 18 hours of notification.

Fort Drum's civilian workforce performs deployment and re-deployment functions in lieu of soldiers.

In addition, the garrison provides numerous other support to Combat Ready Soldiers ranging from Quality of Life Programs to operation and maintenance of training ranges.

The second major service area consist of those services tailored to supporting other permanent, satellite and transient organizations.

The third support area consist of those services necessary to maintain a safe and healthy environment for all soldiers, civilian workers, family members, and the residents of the North Country communities.



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Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 2

EMC #1406-012

DATE: 11 April 1996

PROJECT: Ft. Drum Water Conservation Study
CONTRACT NO.: DACA01-94-D-0033, D.O. No. 12

NOTES: Michael Scholz
PREPARED BY: E M C Engineers, Inc.

DATE OF
MEETING: 1 April 1996

PLACE OF
MEETING: Building 4000, Ft. Drum
Ft. Drum, NY

SUBJECT: Interim Report Review Meeting Notes

ATTENDEES: Steve Rowley, Energy Manager, Ft. Drum
Joe Ogiba, Telemetry System Manager, Ft. Drum
Michael Scholz, EMC Engineers, Inc.

The following is a summary of the items discussed, the comments made, and the decisions made during the kick-off meeting conference.

The meeting began with an overview of the work performed for the water study. The study consisted of the following main elements:

- **Leak Detection Survey and Site Audit.** A leak detection survey was performed by M.E. Simpson, Co.. M.E. Simpson used a combination of listening devices and preamplified-transducer systems to identify leak locations. M.E. Simpson surveyed the 130 miles of water distribution lines at Ft. Drum plus the piping in the water well field. The survey of the well field was confirmed by a phone conversation between Michael Scholz and Michael Simpson on 10 April. M.E. Simpson did not find any leaks in the well field piping.

E M C Engineers, Inc. performed a site audit on the existing potable water distribution system. The audit included tasks such as interviewing post personnel to gain an understanding of the

11 April 1996

Page 2 of 5

current system operation and past history, gathering data relevant to water consumption and electrical usage, and identifying possible energy conservation projects in the water system.

- **Economic Analysis.** Specific energy conservation opportunities (ECOs) were evaluated to determine their economic feasibility. ECOs were evaluated based on current Federal Energy Management Program (FEMP) criteria, according to the scope of work. Analysis included cost estimates and a Life Cycle Cost Analysis (LCCA) for each ECO.

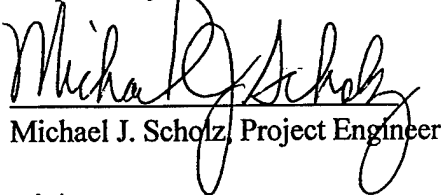
The water study proposed projects that will improve Ft. Drum's water system. Justification for the projects was based on energy savings and economic payback according to the ECIP guidelines.

Mr Rowley and Mr. Ogiba were satisfied with the report stating that the report met their expectations. They did not have any editorial or technical comments to incorporate into the report.

Mr. Rowley requested EMC bundle ECO 4, 5, 6 and 7 together and prepare one DD1391 for the final report. EMC will wait until 15 April for any additional comments. After this date, final document preparation must commence to produce the final report on schedule.

This meeting was adjourned.

Respectfully submitted,



Michael J. Scholz, Project Engineer

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cc: Attendees
Tony Battaglia, COE Mobile
Doug Gray, EMC
Dennis Jones, EMC

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.



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CONFIRMATION NOTICE

Confirmation Notice No. 3

EMC #1406-012

DATE: 14 May 1996

PLACED TO: Mr. Tony Battaglia
REPRESENTING: COE, Mobile
PHONE:: 334-690-2618

PROJECT: Ft. Drum Water Conservation Study
CONTRACT NO.: DACA01-94-D-0033, D.O. No. 12

NOTES: Michael Scholz
PREPARED BY: E M C Engineers, Inc.

DATE OF
CONVERSATION: 9 and 13 May 1996

SUBJECT: Review of Interim Report comments

The following is a summary of the items discussed, the comments made, and the decisions made during the phone conversations.

9 May

- We discussed the Interim Report comments received on 8 May from Mr. Battaglia via Norfolk COE (attached). We discussed the comments were sent by Mr. Battaglia on 9 April and must have been diverted. We asked Mr. Battaglia how we should proceed since the final version of the report had been sent on 3 May.

Mr. Battaglia called EMC after he had spoken with Norfolk COE and mentioned he would like the comments addressed if at all possible. We responded by saying will comply with the request.

- Below are the EMC response to the comments received on 8 May. The comments are not repeated here, as they are attached.
 1. Concur.
 2. Item was added from in-house review.
 3. Will identify.

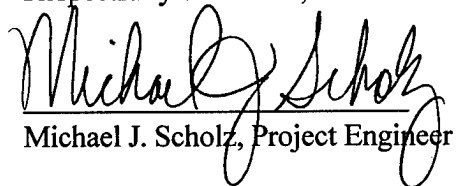
Confirmation Notice No. 2

14 May 1996

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4. Will highlight sentence.
 5. Will change calculations based upon phone discussions with Mr. Battaglia on **13 May**. Discussions were about the merits of performing various different calculations for the annual cost of leak detection of the potable water system. The end result will be presented as Mr. Battaglia suggested in the comment.
 6. Will clarify.
 7. All personnel have been included according to Ft. Drum data.
 8. Will change.
 9. Will change.
 10. Will change.
 11. Will change.
 12. Will modify LCCA summary sheet to list variables in cost savings calculations.
- Mr. K. Butler comment response:
 1. Will change from 18 to 17.

Respectfully submitted,


Michael J. Scholz, Project Engineer

mjs/MS

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cc: Joe Ogiba/Ft. Drum
Steve Mlecik/COE, Norfolk
Tony Battaglia, COE Mobile
Doug Gray, EMC
Dennis Jones, EMC
Tom Poeling, EMC

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

U.S. Army Corps of Engineers

Norfolk District
803 Front Street
Norfolk, VA 23510-1096
voice (804) 441-7894
fax (804) 441-7831

fax transmittal

To: Bill Center
Fax #: 770-552-6759
From: Keith R. Butler
Date: 8 May 1996
Re: Water Conservation Study, Fore Drum, NY
Pages: 2

Notes:

I am reviewing the Water Conservation Study for Steve Mleck. I'm forwarding some additional comments from Mr. Anthony Battaglia and myself. Please revise the study accordingly and provide us with the necessary sheets.

Coment:

Table 2-3, page 2-6:
-The total number of leaks should equal 17 not 18.

Mike Scholz - Call me when you receive this.
Rice,

04/10/98 WED 06:37 FAX 3346902424

USACE

002

| MOBILE DISTRICT PROJECT REVIEW COMMENTS: | | DATE: 9 April 1998 | Page 1 of 1 |
|---|---------------------------------|---|---------------------------|
| TO: Steve Mlacik US Army Engineer District, Norfolk | | FROM: Anthony W. Bartaglia, CESAM-EN-DM Phone: (334) 690-2618 FAX: (334) 690-2424 | |
| PROJECT/FY: FY95 BEAP Water Conservation Study | | | |
| LOCATION: Fort Drum, New York | | | |
| TYPE REVIEW: Interim Submittal | | | |
| NO. | Page/Par | COMMENT | Response to Comment |
| 1. | Pgs ES-1 & 1-1 | Authorization for Study: The Norfolk District of the Corps of Engineers has responsibility for the study and should be mentioned in the authorization. | |
| 2. | Pg 2-1 | Par 2.1: Add "percent" after "8.7". | |
| 3. | Pg 2-2 | Table 2-1: Identify type of service for each motor. | |
| 4. | Pg 3-5 | Par 3.1.5: Suggest highlighting or typing in bold letters the following sentence: "Therefore, fixed costs charged by the DANC and by the City of Watertown are not included in the cost of water calculation." This is a very important step in the development of the costs, and it deserves emphasis. | |
| 5. | Pg 3-11, Pg 3-14, & App D | ECO 5: If the leak detection is to be performed annually, there has to be an annual cost. This annual cost should be treated as an annual recurring non-energy cost. The cost for the leak detection survey for the first year can still be used as the construction cost as shown in Appendix D. Based upon a preliminary try, the ECO should still be cost effective. | |
| 6. | Pg 3-12 | ECO 5: When first reading this discussion, I thought that the metered usage was probably included in the domestic water consumption; but after reading through all of the backup data, I decided that this was not the case. To dispel any notions that this might be double-counting, suggest saying something about the use of the PX, Commissary, and Min-Mall by the off-post dependents and retired personnel. | |
| 7. | App D | ECO 5: In the development of the post population numbers, the unaccompanied active duty personnel have not been mentioned. Certainly there are people living in barracks and BOQs. Please investigate and make corrections as necessary. | |
| 8. | Pg 3-16 | ECO 6: Several places in the discussion of ECO 5 the phrase "improving stagnation" is used. Suggest changing this to "alleviating stagnation". | |
| 9. | Pg 3-16 | Last line: Change "leakage savings" to "water savings". | |
| 10. | Pg 4-2 | Par 4.3: In the last sentence before Table 4-2, change "recommended" to "recommendations" or to "recommended ECOs". | |
| 11. | App D | Type a title on the separator sheet for each sub-section of Appendix D. | |
| 12. | App D | On several of the ECOs in Appendix D there is only a LOCA Summary Sheet and an estimate. Please add a sheet showing the cost savings calculations. For example, on ECO #1, O&M Reservoir Savings = (.028 + .031 + .067) X 56,120. | |
| END OF COMMENTS | | | |

APPENDIX B
FIELD SURVEY NOTES

Field Survey Notes
Data Supplied by Ft. Drum
Telemetry System Data (August 1993 - July 1995)

- Mike anticipates being on site until 10 November.

- Rules and regs on Post? - don't go into locked area.

- photos are sensitive. No photos of bldgs.

- Bristol Babcocks telemetry. by Joe Ogiba.

- Steve Rowley will write a letter to provost

bldg T 213 will be provided for our use.

Lewis St.

- Bill Center discusses the evaluation of cathodic protection. It is not a part of scope for potable water.

- New Post is 6-8 years old

Frank Colburn
John Kerr.

- 4 yrs old - Water telemetry system which controls water system

- chlorine system.

- 11 wells.

- 1.5 gallons/day charged > shallow pipeline? 2400 gpm to 4800 gpm. from Watertown.

- 2,200 gpm wells

- water use is evenly.

- historical background on precise information.

- Sewage goes to Watertown direct.

NC
document
thru
then
mean

show

old area
in well field

- 3 tanks 1 550,000 gals for 1 & 2 tank 2
not used Tank 3 1 mg in new area.

- Tank 1 is highest, Tank 3 is on another elevation
- ✓ - 750,000 gal reservoir - below ground. - 225,000 gal/day turnover.
- ✓ - 1.5 ^{free} ppm injected @ water plant. Site furthest away has .1 or 0.2 ppm.
- ~~Not~~ Low chlorine is not relegated to dead ends - also on Post.
- ✓ - I mentioned need for Mission Statement or/and future use to Joe.
- ✓ - 20,000 people on post
- [REDACTED]
- [REDACTED]
- experience a couple of breaks in spring/year. ^{24 per year}
- ✓ - pressure is - 90 psi in - old area.
130 psi in new area tank #3
- FEMP is energy and water. Water is not as strict. Steve wants to summary of water saving. More Water money than projects.
- ~~call labor to~~
- Tanks over running. - meter? - not anymore - Ogilva
- @ Ft. Drum Water Conservation Study will be context of Steve's submittal to govt.

- Joe estimates constant low flow of 450 gpm. ^{on computer into 600 gpm}
- Bill Center mentions ~~one~~ a couple of A/C's use water on once through.
- hard copy redline map is acceptable to Joe Ogiba.
- John Kerr makes reports for state.
- 13 pH analyzers. 4 installed now, 9 w/in year.
- Telemetry is twofold -
 - be informed of trend towards problem.
 - proactive approach to maintain

9:30 @ Telemetry bldg

- 4th St. East / St Lawrence - 750,000 gal. tank (DANC)
- 45th Division Drive. tank # 3.
- North entry point is furthest point
- ^{saw} - 750,000 gal reservoir on 6th St. north of Railroad.
- They shut down wells over the weekend.
- 2.2 mgd average, Saturday more, Sunday more than ~~that~~
- DANC's
Hydrogeology

 - DANC says 3 mg/day max - not an avg of 3 mg/day or "rate" of 3 mg/day
 - They have a 20 hr UPS @ tele station and @ water station.
 - wells are run on sand - well w/ lowest number of operating hours.

2.2-2.4 MGD Summer } rates
1.6-1.8 MGD winter.

- M.E. Simpson says their maps only cover old H. Drum. We need 3 sets for New H. Drum.

12:30 John Ken & M.E. Simp. & Crew, Bill Center

- AME housing area is PVC in new area
- ~~main~~ post is ^{ductile iron} cast iron. Not much transite pipe left.
- some of the ductile iron was capped a few years ago.

↓ { distribution main - 12"-20" - ductile iron
new post < 12" is PVC
1986 - finished 1989.

old post 1942-1945 age. - A.C. replaced
In the 2000 area and 2800 area maybe as old as 1930. some transite in that area.

- Air port has fire system & fire suppress ^{deluge} sys
2 diesel pumps
1 electric.

Piping Shop - 25589
25574

0159

(5)

77

24131

- Fire department might test flows. Chief Harrell

- New fort has PRVs

- 2 hydraulic valves also at New Fort

- Tank #3 is ~90' high.

- Generally, the old fort has low < 0.5 ppm chlorine.

2200

2400

2300

2100

100

0

1100

4000

6000

} these areas

- All water into new fort goes through 4th St. East 20" pipeline.

- Valve vault @ Conway, valve vault on Lewis Ave.

- pictures of valve vault - confined space.

- on Lewis St. they aren't elec. actuated.

- if line in ~~St. Lawrence~~ ^{St. Oswego} Ave. line is connected, or reopened, then all 12" lines in Old Drum would operate ~1200 LF. from Cragville ~~Ave~~ road west.

- 9100 low chlorine also. Pos. E. Coli. this year.

- no areas of known low pressure.

- Fire Dept @ 10710 area - Conway, memorial to L South River Ridge Loop.

10/25/95 8:05 @ Joe Ogilvie's office. 315-7723322

10/25

(7)

requested of Joe:

- water drawings in New Fort. - re delegates to Rick
- utility rates of DANC facility since Ft. Drum pays for utility.
- escort to wells.
- utility (water use) of power facility.

8:25 - @ DANC

Video interior, Tom takes Nameplate

Joe wants to have us meet Tom Ferguson. for HTHW.

Joe wants to have cathodic protection monitoring as part of SCADA system.

Requests of John Kerr

- Video tape vault to reconnect to SCADA for Cl₂ enhancement
- keys & (escort) to wells or - } EPC's asked for info.
- nameplate data of pumps & motor.
- brief overview water system again.

Requests of Tom Ferguson

- Emergency response plan
- Total Army Quality Self Assessment. ✓ received
- Ft. Drum water is basic, Watertown water is slightly acidic - how does it effect Cl₂ amount?

11/55
(8)

- They have a well drilled which would produce 700-800 gpm. Needs power and waterline const. what is estimated l.f. ~~so~~ from well to water network.

- Shallow pipeline - no shallow depth. ~ burial is about 4'-5'.

- HTHW parallels cold water - operates @ 360° during ~~water~~ winter could be a temperature problem between the two pipes.
[supply & return civil system. 12" ϕ .

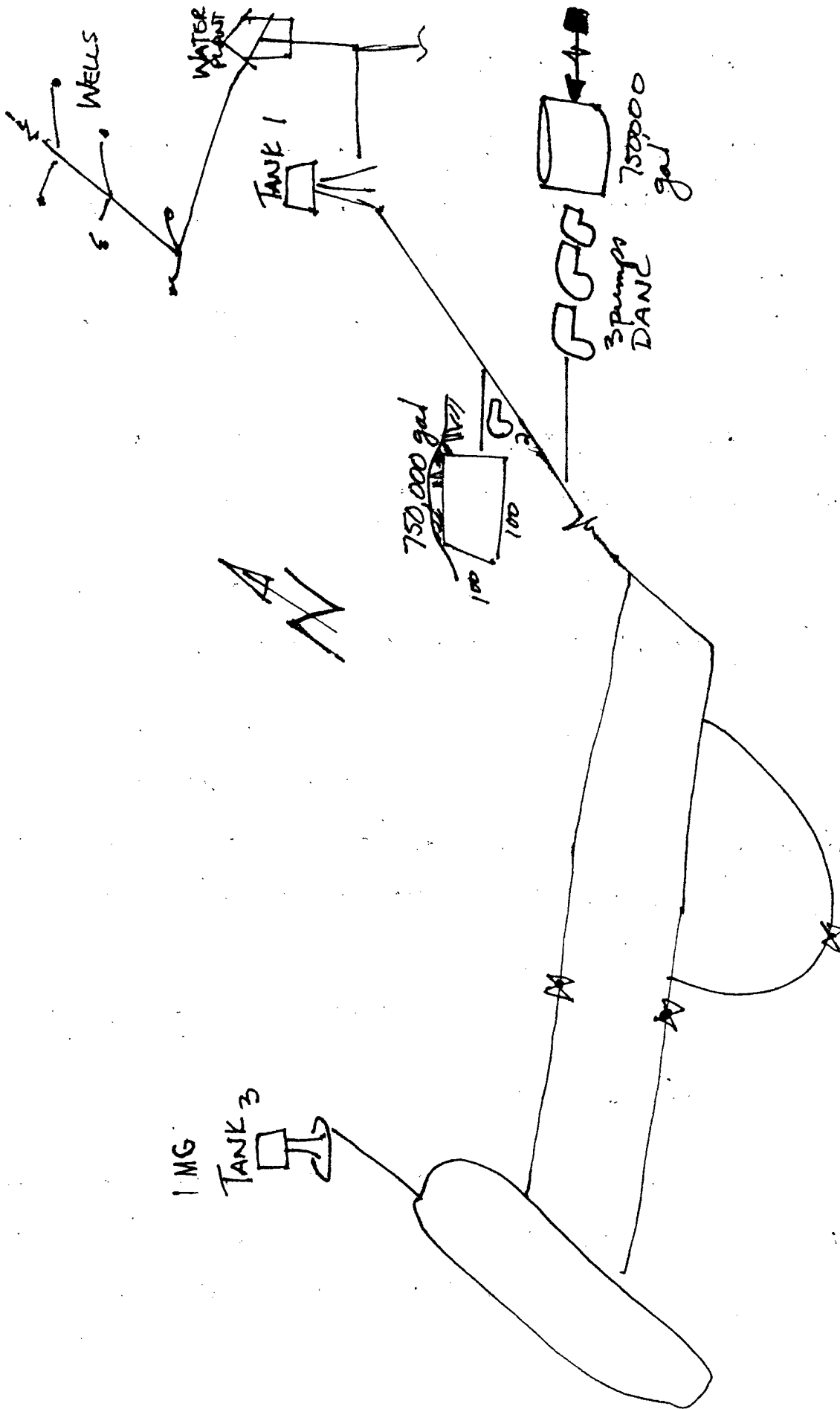
10/25/95 10:30 Wayne Davis helps w/ nameplate data on wells in files

& water map of new fort: File No. 7549-00-13950

10/26/95

verify:

- pump in ground storage
- pump(s) @ water treatment
- water vault photos.
- wells - submers or vert. turbine
- ~~o~~ computer tape
- water map? on site map.
- copy of screens of Joe's program.
- need John's map(s)



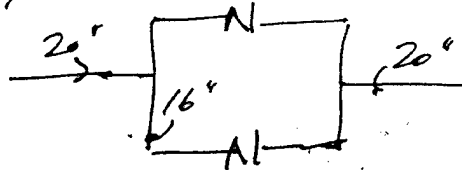
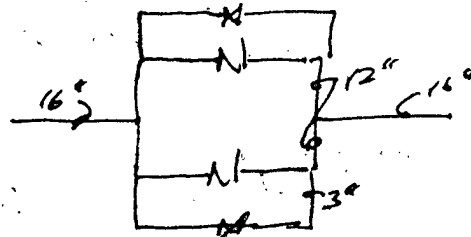
10/26/95 before mtg w/John Kerr 10:15

- ✓ - Verify wells. - submersible pumps - vert turbines were orig. control valve.
- ✓ - get into reservoir for nameplate data, & Vault
- ✓ - get info for operating hours for wells.
- estimated hrs. sprinkling ath fields. - Frank may know
- Stop by fire dept to get fire flow info.
- how often XR size fire hydr's? - 3yrs for old pot all hydrants
- ✓ - chlorine usage figures? DANC vs. Drum.
- air conditioners use water once through. - HVAC shop
- get elec. file of map. ^{Ed Rear is supervisor}
- ✓ - ask John about maps.

10/26/95 John Kerr 3pm

Control valve vaults:

16" vault - 3" bypass lines are there for low flow. When higher flow, control valves (12", 16") open.



10/26 w/ Bob Bellinger

LZA did master plan work. He has gas & water drawings. Lev Zetlin, New York New York. 641 Ave of America.

10/27/95 Joe Ogiba.

3.5772 9613 (fax)

Field survey Notes - Ft. Drum Water Study

Joe Ogilvie (315) 772-3322

Ft. Drum Water Conservation Study

Items needed:

- Cost of water, electricity, utilities (2 yrs)
- Amount of water consumed (meter data)
- Identification of potable water system.
- " of " " usage:
 - Population data
 - Fire hydrant usage
 - Industrial uses
 - Irrigation, landscaping
- Pump nameplate data, operating hours
- Prior studies
- Future plans, mission statement
- Hold to report prep. discussed in row?

Kicheff Meeting 10-24-95

- Scholz - Explains row. Leak detection survey, methods of energy conservation regarding water system, UCA, cost estimates. Provide interim submittal, review, final submittal, programming documentation. (Basis of fee)
- Grimson - Explains leak detection. Uses leak correlator. Listens to pipe - hears sound that travels from point to point. Listen to all valves, hydrants in all distribution system.

TCP

(2)

Verify noise areas twice. Use microprocessor to check pipe type, size, material, define precise location of leak. Go in and estimate amount of leakage. Can find leakage from other pipes? Very seldom. Usually must be touching.

How to estimate water leakage? Best way is to excavate. Look at design pumping vs. actual. Look at pipe pressure, type to estimate leakage rate.

How to estimate water usage - End usage, water audit.

- Simpson - Will work now until November 8-10. Except Sundays. Rules, regs to follow while on post? Any off limits parts of post. Need regular on-post personnel POC? Joe Ogilvie - POC.

- Very sensitive of photos. Hydrants, excavations, leaks.

- Bldg. T-213 - Used to store equipment, can use as base.

Kickoff Meeting 10/24 (cont)

- Center - Would like to remove SCW regarding on cathodic protection for this water project.
- Review basis of fee for Jac Ogden look for problems - stagnation lines.
- SCW reviews entire post. Problems w/ stagnation have been in new post.
- New post was built 6-8 yrs. ago. New lines - Frank Coburn, John Kleins. Plumbing shop POC.
- Telex monitoring system - Have 3 1/2 yrs. of data available - Lotus compatible. Every thing is controlled - 9 liter - master unit. Have 11 wells. + commercial source (charged for 1.5 mgd) - Avg. monthly. Subsiding w/ 2200 gpm with well. Can pull up to 4500 gpm - commercial. Electronic interface with well pumps. Interface w/ commercial source - above ground tank. Can provide electronic copy of data.
- Stagnation line - Keep water moving. Recirculating water back to plant. Getting bacteria in places w/ high chlorine. Sporadic in places. Did take samples on bacteria this summer no results - think results are inconclusive.

TCP
(4)

Circ.
11/15/85
ELOS

- Financial justification for Magnation - Amount to flush + disinfect lines - they have data. Do have problems in housing area.

- Summer drought - 1/50 of avg. rainfall this year.

5 From Black
water (river)
DANC.
Development
Authority
of North
Country

City water - bacteria free? Pumping water from Watertown. Sewage goes straight to Watertown. Water from Watertown - surface water. Run through pepi - 1 day turnover. Do have problems w/ surface water - particulates.

- There are 3 tanks (1-2 old area - 250,000 gals) Tank 3 - 1 million gal. - new area. Tank 1 turns over quickly 92-82 ft.) Tank 2 is not being used. Have 750,000 gal. below ground reservoir. Used as well - pump into that reservoir high turnover. 250,000 gal/day.

1.5 ppm
chlorine
(free)

- Site furthest away - Sewage pumping station (no use) - 0.2 - 0.4 ppm chlorine.

- Old piping in old area. Not as much usage to circulate enough water to keep residuals down.

- Request future mission statement. Approx. 20,000 people on-post (avg.) Will get last year's population data. [REDACTED]

- Many water main breaks. Couple during the spring (mainly) - Problems with old pipe, new pipe on rocks.

- Working pressure - 90 psi - Tank #1
125 psi - Tank 3 (new area)

- FEMP has separate category for water conservation. Not as stringent. Not as high competition for water projects. Don't have to compete w/ energy conservation programs for funding.

- ECOs
- Fix nuisance leaks as ECO - 24 to 50 gpd/leak.
 - " stagnation problems - circ pumps, lines
 - Upgrade tele-metering. (Tanks overflowing)

- Tele metering - May have leaks in well field. Gpc is trying to reduce un-accounted for water. (Avg. 450 gpm)

- Do have some domestic water for once-through cooling - condensers. Need to look.

tel
⑥

- Prefer red-line mark ups of water line system maps.
- Steve thinks this is one-time study. Water audit should be put in report.
- ECD. improve meter system to determine unrecoverable leakage. System (radio) prints report once a day.

5

- Chlorine injection now based on flow (23 chlorine/pH analyzers - 23 installed) will automate water system.
- ② Don't want to wait for problems. System allows for proactive maintenance.
- System (water) - 3 years old. In process of putting on gas, electric, other systems.

Old Area - bldgs. are deactivated for winter. Have stagnation problems.

Airflow tanks just 23 hrs/yr. to skim top surface of tanks.

Are peak pumping?

Shot well field down on weekend, saves operating time. Turns off on Sat. 8am - Mon 8am. Use DANC water during weekend. Weekend is highest use - Sunday.

- Wells turn on based on feet. Wells are rotated by operating hours. Longest operating hours are turned off first. Are some wells that are turned on all the time (except weekends).
- Pay for 1.5 mgd - avg. over month (Demand type rate) Can pump up to 3 mgd from DANC. DANC pumping station - 4 yrs old.
- Telemetry system - Bristol Babcock - very reliable UPS system - 20 hrs. for power outage.
- At 8 am. They can change well setpoints based on tank height and water daily usage.
- Use one well continuously for chlorine, but switch well use around (about weekly).
- Telemetry system = \$6500-7500 per unit. Payback about 4 years.
- Usage movements - don't change water usage. Wives Summer - 2.2-2.4 mgd (avg.) Still here. Winter - 1.6-1.8 mgd. "
- Don't use 1.5 mgd always from DANC because they keep well on for chlorination. They pay for 1.5 mgd regardless.

tcp
(3)

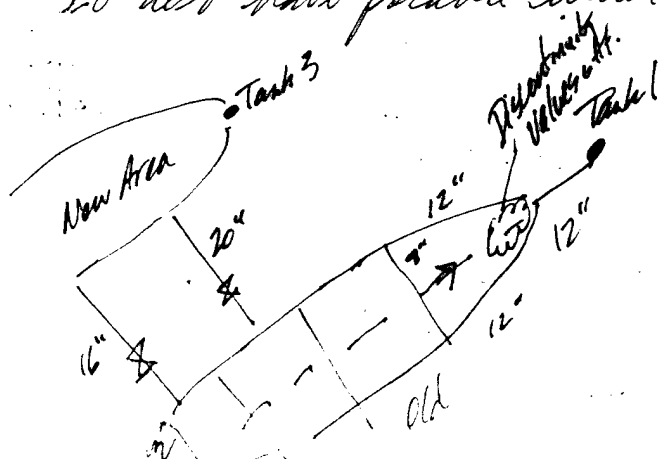
- Two chlorine injection pump. Pump 1 is on even numbered months, pump 2 on odd numbered pump.
- Only manual operation. Change chlorine filter cylinder (about once a week).
- Very good water quality outside of wells. DANC water is surface water - not good as quality.

John ~~Kerr~~ Kerr

Water lines - Ductile iron, PVC (housing) New
" " - ~~cast~~ iron, isolated tranite, cement piping. (Old section).

Took tranite out of service - left them abandoned.
Some bldg. removed (old) - capped lines.
Dwg. File 92-118 "Replacement of Tranite Water Pipe"
Cues 300, 400, 500, 600, 2200.

Airfield has separate fire protection system.
It also have potable water system.



Would like to create two small projects to finish valve connection to 16" line and valve to 8500 Area. Everything is ready to go just needs to be fine-tuned (manually).

- Fine-tuning - with one man at Tank 3, one or two at valve 16" and one or two at 8500 PRV, one other person to see pressure. (Would take three guys about two weeks to do one valve at time.)

- Could add RTU (remote sensing unit) to 8500 unit - all set up to do it.

- 20) - Look at replacing discontinuity near Tank 1. All 3-12" flowing to meet demand in 16"-20". But is feeding a 12" manifold - could make 12" manifold larger to feed all 12". However, it might fix hydraulic problem to new area, but wouldn't fix chlorine stay - problem to 8500 Area. (that is priority)

- Lines shut down - Oswego from Lehighville Road - about 1200 LF. All mains should be ~~shut~~ preharized. (low chlorine residuals)

- Have bacteria growth in 9000 Area. Couldnt verify any cross connection. Housing will not have any backflow preventers, unless their heaters.

10/10

- Never have problems with low pressure in distribution systems.

Fire Station
10/24-95

- Fire hydrants are exercised as requested. Use hydrants for usage, not for mission.
- Maintenance shops will open hydrants for maintenance

For
10/24:

- Question: DANC facility - Does Ft. Drum pay for electrical pump usage on top of 1.5 mgd. water charge.
- Need drawings of new Ft. Drum.
- Compile data: 11 wells, water treatment plants, DANC facility.
- Video of control valves (16")

10/25

Tom Ferguson

- High capacity, low demand in system
- Change in quality of water since gone to DANC (surface water worse than well water). PH changes probably corrosion problems with pipe reactions.
- Projects: Non-peak pumping, ② lower usage from DANC to 1.5 mgd usage.
- ③ Optimize PH with optimum chlorine levels.

- * Does sow include raw water transmission lines from well fields? Will check with M.E. Simpson.
- 3.4 yrs. ago removed travertine ^{poor condition (50 yrs.)} pyning. Replaced with cement lined ductile iron. Had some asbestos traces in water. Also abandoned in place some of transite pipe. Use PVC on residual areas, smaller diameter.
- Non-peak pumping - lower tanks, use wells during peak times. High storage capacity in system.
- Unrecoverable ^{water} ~~data~~ - Approx. 400-600 gpd assumed (Joe)
- * Emergency Response Plan written, Total Army Quality Self Assessment - Information regarding mission statement.
- Have had trouble with biofilm contamination (some covered pipe) throughout base. with State health. Bacteria had resistance to chlorine.
- Water from Waterfurn - Acidic wells - Basic (High Chlorine)
- * low chlorine demand for well water, good quality. Use more well water in summer than in winter.

TCT
②

- low usage in winter (1.5 mgd) use mostly DANC water.
- Is 1.5 mgd level for DANC the optimum level to be at for Ft. Drum.
- May have more flexibility in future. Capital expenditures are getting paid off. O+M expenditures would be less.
- Can pump more water (Have new well that could pump 200-300 gpm with no problem but would need to connect piping and electrical to it (only well is drilled) without having to use more water from DANC.
- Pass recommendations for water use/DANC on what is good for Army. Let them worry about political issues w/ using DANC water.
- Piping is buried 3-5' in ground. Have HTHW 350°F, 500 psi, 2" mineral wool. That runs parallel to domestic water. May warm DW. May be some physical connection. Heat may be promoting bacteria growth combined with low flow in system.
- low flow rates - moderate temps. HTHW buried in Ricwil system, supply + return buried in same 12" conduit.

F/G - Franklin Motor/Could Pumps

TCT

(13)

Well Nameplate Data - Plumbing Shop

Well #1: US Motor SN 234474
20 HP, Layne Pump Type DRHC
Not operating 10/10/87, pump worn out

F/G) Well #2: 40 HP submersible (Dug) - 2/82 (Kumo pump) 870 - 6"

Well #3: 20 HP Franklin submersible with (7/78)
Coults pump 5-stage. and 75 KW Generator
Cummins - Mohawk. (Model 2361059006 motor)

Well #4, 5 - 40 HP u/Coults (7/78)
pump, 3 stages, 100 KW Generator - Cummins/
Mohawk
1/15/88
2 70/83
avg.

F/G) Well 6- 15 HP submersible pump (2/82) (Base bid)
SN 150H156632

F/G) Well 7- " " (2/82) "
SN 150H156632

Well 8- " " (2/83) "

F/G) Well 9- 20 HP " (2/82) "
SN 225H206632

F/G) Well 10- 25 HP " (2/82) "
SN 225H256632

Well 11- 40 HP Franklin submersible with Coults
pump, 3 stages (Motor Model 2391006102)

Well 12- 30 HP Franklin submersible with Coults
pump, 3 stages. (Motor Model 2361179006)

10/26
(14)

Joe Chika - 10/26

8 am

Operating sequence:

Major sources of water: ① DANC facility
② Well pumps

Well pumps are turned on one at a time based on height of tank. Wells (additional) are brought on line as more water (test) are lost out of tank. Which well comes on depends on operating hours of well pumps. Lowest operating hours well comes on first and goes off last.

They change setpoints of tank levels all the time to balance usage with DANC water. (Setpoint higher turns on wells faster to use more well water, lower uses less.)

* Get operating hours of wells from John Kerr.

→ Consumption also dependent upon heads - change dependent upon season.

Reservoir Pumps

2 pumps - 75 HP, 75 HP (never used) 75HP is reserve pump but has never been used.

C.V. automatically controlled to open/closed

One for low pressure, one for system pressure (but not used)

- 35 HP pump turns on when first well comes on to exchange 150,000-200,000 gpl. out of tank reservoir. Helps to improve chlorine residual. Pumps into the system. Take it for emergency use.

- Reservoir - Can not go below 6' level (10' full) for contingency for system.

*
LST

- Operating hours are available in database. Requested from Gpc to look at operating hours of 35 HP - look at one week in summer, one in winter - extrapolate total energy usage.

- Irrigation: Headquarters, parade fields, football fields. Water - end of June, to mid-Sept. Headquarters - 16-20 hrs/day.

*
• Ask about irrigation uses in parade grounds. (John)

- Electric charges: \$3,172 customer charge (min payment)

Demand KW: \$7.02

On Peak kWh: \$0.06196

Off Peak kWh: \$0.05197

Reactive Kilovolt Ampere (RKVA)

John Green
Utility Specialist
772-4451

Bundle price: \$0.072/kWh includes all kW, kWh
Prices what Ft. Drum pays.

TCL
(16)

John
Kerr
11am

Submersible pumps were replaced from 1980 on. All medical turbines have been removed.

John
Kerr
3pm

Central Valves - 16"

- Has two main 12" lines and two 3" bypass lines. 3" bypass used when low flow.
- John would like to alternate 16" - 20" line every month. Would like to alternate two lines upon same pit every 2 weeks.
- 20" vault: 2-16" lines, no bypass.

- Have procured the FM and hardware connection to vault. Material cost has already been taken care of. Would only require labor manhours to connect it to T-4000 (master)

- Plumbing shop in monitoring station is slave to T-4000 master station.

Fire Dept.
2:30 pm

4131

Supervisor

- Water treatment plant - May have info. on fire hydrant testing. 24515

- Hydrants in older area - 65-75 psi
- " " newer - 45-50 psi

Ed R⁴ - HVAC Shop

- Once-through cooling units: 2-3 ton units all water cooled. Also 10 ton unit. Also some refrigeration units.
- Estimates operator 4 months/year. Use about 100 gpd (10 ton unit). 3 ton unit uses 50-60 gpd. Walk-in coolers (4) - 1 ton units total of 100 gpd.
- Use of water cooled. don't have space to install air cooled condenser. Don't recommend changing.
- Also have unit at refing. plant. Evaporative cooling condenser (summer - water cooled, winter - air cooled) Unit probably uses 100-200 gpd.
- Very little maintenance problems with water cooled system.
- * • Water usage for make-up water for heating steam boilers. Several hundreds of boiler-closed systems - use little water, but several units.

708
(18)

10/27
10am

Central Wash Facility

There are two facilities that use recycled water from ponds. Once water in wash bay depletes levels in ponds or becomes poor quality, they will replenish or replace the water in ponds. No meters on usage - depends greatly on number of factors (troop needs, weather, etc). Jee will investigate usage.

4/ptable
water

→ Joe Ogden - Fax (35) 772-9613

10/28

Additional Questions:

- Location of previous water main breaks? Bad sections
- Schedule - Notice to Proceed?

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
Suite C-200 Suite 220
Denver, CO 80227 Roswell, GA 30075
(303) 988-2951 (404) 642-1864

JOB Fl. Drum Water Study 1406-612
SHEET NO. 1 OF 5
CALCULATED BY TOP DATE 10-25-95
CHECKED BY _____ DATE _____
SCALE Field Survey

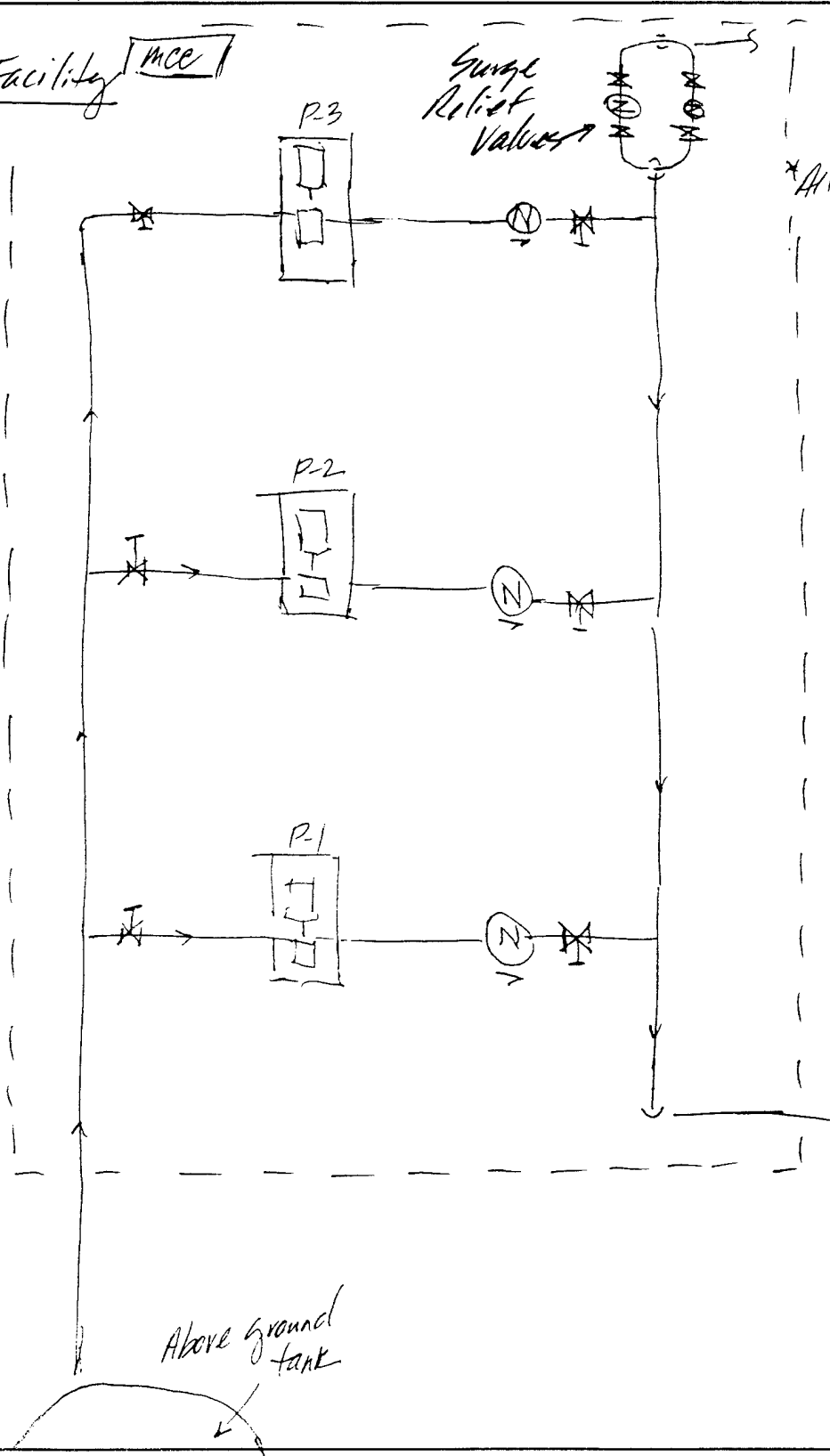
DANC Facility mce

Gauge
Relief
Valves

*All valves - butterfly

Along
Exterior

Above ground
tank



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Denver, CO 80227
(303) 988-2951

9755 Dogwood Rd. Suite 220
Roswell, GA 30075
(404) 642-1864

JOB Et. Drum Water Study
SHEET NO. 2 OF 5
CALCULATED BY TCP DATE 10-25-95
CHECKED BY _____ DATE _____
SCALE Field Survey

DANC Facility Booster Pump Station #2

Motor #1: US Electrical Motor

ID# 640881/T11T2180197R-1

150 HP, 460V, 169A, 3 ϕ /60 Hz

Frame: 447T, Type: TE, 1750 rpm

Design B, Code F, SF 1.15, Ins. F.

Norm. Eff. 96.2, F.L. P.F. = 86.7, Max KVAR = 22.3

Lower Shaft Pkg: 6220-J/C3, Upper: 6313-J/C3

Pump #1: ITT A-C Pump

Size: 10 x 8 x 175

SN: 1-11657-02-1, Type: 8000

2100 gpm, 195' HD, 1785 rpm

Model #150, Imp. = 15", 175 psi

Frame: F-20-E2, Inb. Pkg: 6309

Out. Pkg: 5308

Installed: 1990

Motor/Pump Typical of (3)

Motor #2: US Motor

ID# 640881/T11T2180197R-2

Pump #2: ITT A-C Pump

SN 1-11657-02-2

Motor #3: US Motor

ID# 640881/T11T2180197R-3

Pump #3: ITT A-C Pump

SN 1-11657-02-3

Operating at 90 psi

Pump has altitude (check) valve on discharge piping which senses differential pressure between suction side and discharge. Pump pushes against same pressure regardless of tank height. Pump independently of distribution pressures.

BPS #1 is off-post, operated by DANC, to fill tank.

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JOB H. Drum Water Study
SHEET NO 3 OF 5
CALCULATED BY TCP DATE 10-25-95
CHECKED BY _____ DATE _____
SCALE Field Survey

DANC Facility BPS #2 - System Parameters

Suction/Pressure Chart

- Discharge Pressure - 90 psi (± 2 psi) Pump running
0 psi " off
- Suction Pressure - 7-15 psi (depending on tank level)

Flow Chart

- 2.0 - 4.1 MGD w/one pump running
- 4.0 - 6.0 MGD w/two " "

Tank Level Chart

- 16'-31' - normal operation
- 32.5' - overflow level + alarm
- 31' - BPS #1 pumps off
- 16' - " " on
- 15' - low tank level + alarm
- 14' - BPS #1 both pumps run

Chlorine Analyzer

- 0.05 ppm - low chlorine residual alarm
- 0.8 ppm - turns chlorine system on
- 2.0 ppm - " " " off
- 4.0 ppm - high chlorine residual alarm

These are current figures.

BPS #1 - 3 pumps

BPS #2 - 2 pumps 0.5 - 0.5

E M C ENGINEERS, INC.

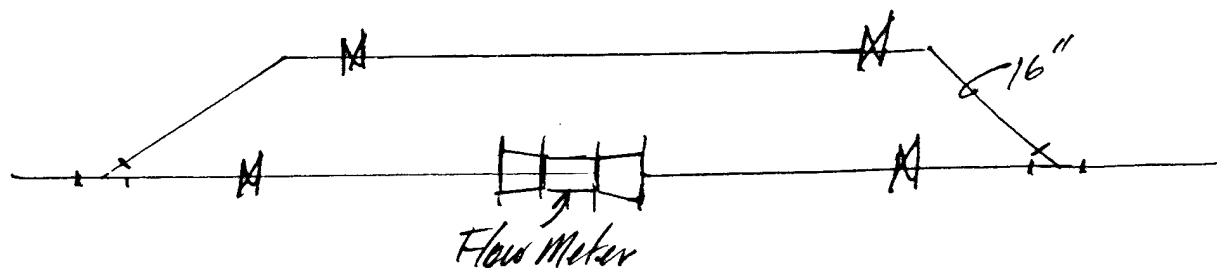
2750 S. Wadsworth Blvd. 9755 Dogwood Rd.
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Denver, CO 80227 Roswell, GA 30075
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JOB Ft. Drum Water Study
SHEET NO. 4 OF 5
CALCULATED BY TCP DATE 10-25-95
CHECKED BY _____ DATE _____
SCALE Field Survey

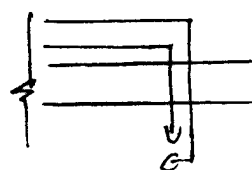
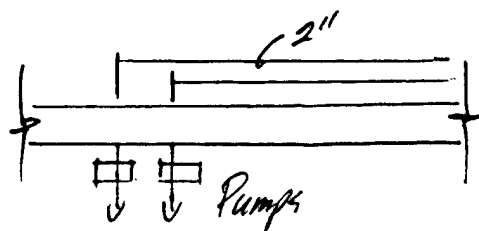
Water Treatment Plant

- Pump #1: General Electric Model # 5K184AL 217D
5HP, 230/460V, 14/7 A, 1725 rpm, 3 ϕ /60Hz
Frame: 184T, B Ins., Design B, SF 1.15
Brq. 30BC02XP, Inner: 25BC02XP
Typical of 2 pumps (100psi)
- Brooks-Mag Magnetic Flow Meter
Model # 7508C1A2C1AAAA, SN 9401-34973-1-1
K-Factor: 108.157 gpg, 285 psi, 1.965 MPa Max Press.
185°F Max Temp.

Elevation



Plan:



E M C ENGINEERS, INC.

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JOB Ed. Drum Water Study
SHEET NO. 5 OF 5
CALCULATED BY TCP DATE 10-26-95
CHECKED BY _____ DATE _____
SCALE Field Survey

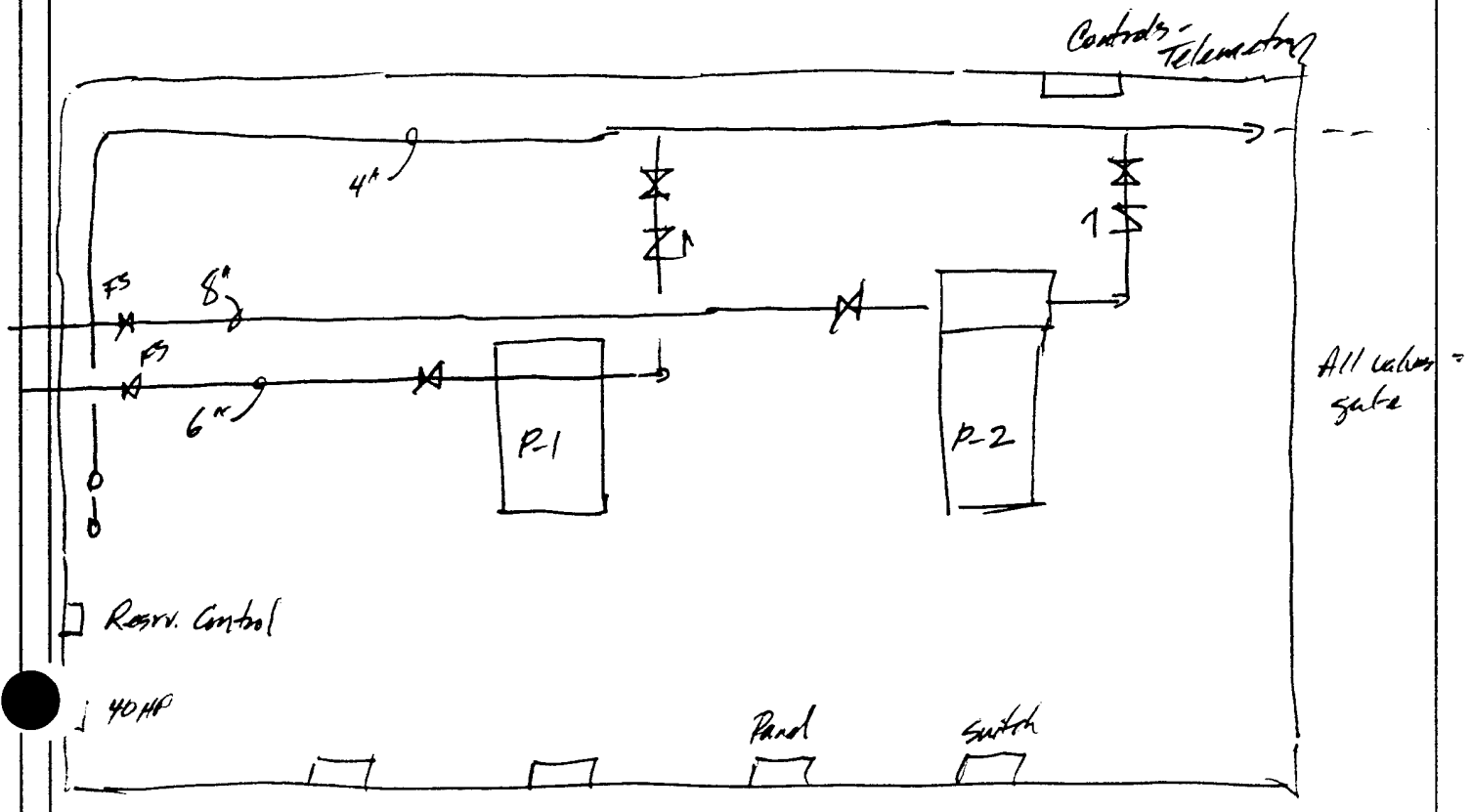
Reservoir Pumps

Pump #1: Westinghouse Electric Style 1077328
SN 542

40 HP, 220/440 V, 97.3/43.6 A, 1760 rpm, 3 ϕ /60 Hz
Dayton-Dowd pump

Pump #2: Louis Allis Co. # 564460

75 HP, 220/440 V, 190/95 A, 1770 rpm, 3 ϕ /60 Hz
Frame: 5055, Type FX, Class 2A



THE PUMP IN THIS WELL IS POWERED
BY A FRANKLIN SUBMERSIBLE MOTOR

MODEL 2361176010 HP 30 PH 3
VOLTS 460/380 RPM 3450/2875 HZ 60/50
MAX AMPS 46.0/50.3 CONTINUOUS DUTY
SF 1.15/1.00 KVA CODE J/G
MIN FLOW FT/SEC 0.5



Franklin Electric

Bluffton, Indiana 46714

THE PUMP IN THIS WELL IS POWERED
BY A FRANKLIN SUBMERSIBLE MOTOR

MODEL 2361056010 HP 20 PH 3
VOLTS 230 RPM 3450 HZ 60
MAX AMPS 61.0 CONTINUOUS DUTY
SF 1.15 KVA CODE J
MIN FLOW FT/SEC 0.5



Franklin Electric

Bluffton, Indiana 46714

THE PUMP IN THIS WELL IS POWERED
BY A FRANKLIN SUBMERSIBLE MOTOR

MODEL 2361186010 HP 40 PH 3
VOLTS 460/380 RPM 3450/2875 HZ 60/50
MAX AMPS 60.0/64.1 CONTINUOUS DUTY
SF 1.15/1.00 KVA CODE J/H
MIN FLOW FT/SEC 0.5



Franklin Electric

Bluffton, Indiana 46714

| | Well No. 2 | Well No. 4 | Well No. 6 | Well No. 7 | Well No. 3 | Well No. 9 | Well No. 10 |
|--|---------------|---------------|---------------|---------------|---------------|---------------|----------------|
|--|---------------|---------------|---------------|---------------|---------------|---------------|----------------|

Existing Pump
Motor Horsepower

| | | | | | | | |
|----|----|----|----|----|----|----|--|
| 40 | 15 | 15 | 15 | 15 | 20 | 25 | |
|----|----|----|----|----|----|----|--|

Pump capacity,
g.p.m. at total
head

| | | | | | | | |
|-----|----|-----|-----|----|-----|-----|--|
| 440 | 80 | 130 | 160 | 80 | 200 | 230 | |
|-----|----|-----|-----|----|-----|-----|--|

Discharge Pres-
sure at top of
well, lbs.

| | | | | | | | |
|----|----|----|----|----|----|-----|--|
| 95 | 65 | 75 | 75 | 90 | 80 | 125 | |
|----|----|----|----|----|----|-----|--|

Well casing
I.D., in.

| | | | | | | | |
|------|-------|-------|----|-------|---------|-------|--|
| 18x8 | 18x10 | 18x10 | 12 | 18x10 | 18x10x8 | 18x10 | |
|------|-------|-------|----|-------|---------|-------|--|

Datum elevation
(floor)

| | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--|
| 612.99 | 684.50 | 684.26 | 672.60 | 670.22 | 649.67 | 593.11 | |
|--------|--------|--------|--------|--------|--------|--------|--|

Static Water
Elevation, ft.

| | | | | | | | |
|------------------|------------------|------------------|----|------------------|------------------|----|--|
| 602 ⁺ | 642 ⁺ | 642 ⁺ | -- | 633 ⁺ | 590 ⁺ | -- | |
|------------------|------------------|------------------|----|------------------|------------------|----|--|

Existing Pump
Setting, ft.

| | | | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|--|
| 44 ⁺ | 80 ⁺ | 85 ⁺ | 85 ⁺ | 65 ⁺ | 105 ⁺ | 40 ⁺ | |
|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|--|

Total Depth of
Well, ft.

| | | | | | | | |
|-----|----|----|----|----|-----|-----|--|
| 108 | 90 | 92 | 90 | 76 | 190 | 100 | |
|-----|----|----|----|----|-----|-----|--|

Well Pump Motor - Ft. Drann

Well #

2- 8 JLC 40HP Sumo 6"

6- 150H156632 15HP Franklin 4"

7- Same as 6 4"

9- 225H20 6632 20HP Franklin 4"

10- 225H25 6632 25HP Franklin 4"

All Pumps are Gould

Well Pump Motor - H. Drum

| | model name | HP | Volts | Date Cos. |
|-------|--------------|------|---------|-----------|
| #3 - | 2361059006 - | 20 - | 230 | Dec 79 |
| | Subtotal | 40 - | 460/380 | Jan 580 |
| #11 - | 2391006102 | 30 - | 460/380 | Nov L. 79 |
| #12 - | 2361179006 | | | |

FT DRUM FIRE DEPARTMENT

October 26, 1995

Hydrant number : 8506
 District : 00
 Location : JACKSON LOOP 8548
 Make : WATEROUS
 Thread type : S
 Available water : 0 as of / /
 Class : RED

Inspection month : 05
 Aux pumps : NO
 Out of service : NO
 Date out : / /
 Corr factor : 0.90
 Add Corr factor : 1.00
 Card marked :

| DATE | TIME | TESTED BY | PORT SIZE | STAT PRES | RES PRES | GPM | REMARK CODES |
|---------|-------|--------------|--------------|--------------|-------------|------|-----------------|
| 5/20/93 | 15:12 | ASHLINE | 2.50 | 60 | 40 | 1061 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |

FIRMS HYDRANT CARD

FT DRUM FIRE DEPARTMENT

October 26, 1995

| | | | |
|-----------------|----------------------|------------------|--------|
| Hydrant number | : 8004 | Inspection month | : 05 |
| District | : 00 | Aux pumps | : NO |
| Location | : GEN GRANT DR. 8005 | Out of service | : NO |
| Make | : WATEROUS | Date out | : / / |
| Thread type | : S | Corr factor | : 0.90 |
| Available water | : 0 as of / / | Add Corr factor | : 1.00 |
| Class | : RED | Card marked | : |

| DATE | TIME | TESTED BY | PORT SIZE | STAT PRES | RES PRES | GPM | REMARK CODES |
|---------|-------|--------------|--------------|--------------|-------------|------|-----------------|
| 5/20/93 | 13:28 | ASHLINE | 2.50 | 84 | 48 | 1163 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |
| / / | : | | 0.00 | 0 | 0 | 0 | |

FORT DRUM'S WATER USAGE

| | DANC WATER | WELL WATER | TOTAL WATER GALLONS | GALS PER DAY | % OF WATER PURCHASED | % OF WELL WATER |
|--------|---------------|---------------|------------------------|-----------------|-------------------------|--------------------|
| OCT 93 | 43,488,630 | 15,313,635 | 58,802,265 | 1,896,847 | 73.96% | 26.04% |
| NOV 93 | 42,813,663 | 9,806,692 | 52,620,355 | 1,754,012 | 81.36% | 18.64% |
| DEC 93 | 46,743,913 | 11,572,348 | 58,316,261 | 1,881,170 | 80.16% | 19.84% |
| JAN 94 | 46,503,684 | 15,353,848 | 61,857,532 | 1,995,404 | 75.18% | 24.82% |
| FEB 94 | 41,222,663 | 10,786,765 | 52,009,428 | 1,857,480 | 79.26% | 20.74% |
| MAR 94 | 46,726,426 | 15,474,860 | 62,201,286 | 2,006,493 | 75.12% | 24.88% |
| APR 94 | 41,829,710 | 7,526,368 | 49,356,078 | 1,645,203 | 84.75% | 15.25% |
| MAY 94 | 45,029,906 | 11,867,234 | 56,897,140 | 1,835,392 | 79.14% | 20.86% |
| JUN 94 | 44,536,151 | 21,973,407 | 66,509,558 | 2,216,985 | 66.96% | 33.04% |
| JUL 94 | 46,427,149 | 24,059,671 | 70,486,820 | 2,273,768 | 65.87% | 34.13% |
| AUG 94 | 46,500,721 | 17,838,670 | 64,339,391 | 2,075,464 | 72.27% | 27.73% |
| SEP 94 | 40,857,108 | 11,493,547 | 52,350,655 | 1,745,022 | 78.05% | 21.95% |
| FY 94 | 532,679,724 | 173,067,045 | 705,746,769 | 1,933,553 | 75.48% | 24.52% |
| OCT 94 | 38,856,675 | 7,094,404 | 45,951,079 | 1,482,293 | 84.56% | 15.44% |
| NOV 94 | 36,107,144 | 6,330,919 | 42,438,063 | 1,414,602 | 85.08% | 14.92% |
| DEC 94 | 46,306,777 | 7,823,514 | 54,130,291 | 1,746,138 | 85.55% | 14.45% |
| JAN 95 | 46,471,194 | 14,400,370 | 60,871,564 | 1,963,599 | 76.34% | 23.66% |
| FEB 95 | 41,133,980 | 10,328,010 | 51,461,990 | 1,837,928 | 79.93% | 20.07% |
| MAR 95 | 46,226,124 | 9,866,787 | 56,092,911 | 1,809,449 | 82.41% | 17.59% |
| APR 95 | 46,010,361 | 7,600,496 | 53,610,857 | 1,787,029 | 85.82% | 14.18% |
| MAY 95 | 47,105,160 | 17,641,697 | 64,746,857 | 2,088,608 | 72.75% | 27.25% |
| JUN 95 | 51,915,343 | 33,108,355 | 85,023,698 | 2,834,123 | 61.06% | 38.94% |
| JUL 95 | 45,275,548 | 36,901,399 | 82,176,947 | 2,650,869 | 55.10% | 44.90% |
| AUG 95 | 45,425,295 | 32,655,708 | 78,081,003 | 2,518,742 | 58.18% | 41.82% |
| SEP 95 | 44,865,012 | 22,623,044 | 67,488,056 | 2,249,602 | 66.48% | 33.52% |
| FY 95 | 535,698,613 | 206,374,703 | 742,073,316 | 2,033,078 | 72.19% | 27.81% |

FORT DRUM

METERED WATER USERS

FY 94 FY 95
K GALS METERED

| | | |
|---------------------------|-------|-------|
| P-10730B PX | 1,623 | 1,703 |
| P-10720 BURGER KING | 389 | 376 |
| P-10502 SPINNERS | 538 | 557 |
| P-2300 OLD PX | 558 | 599 |
| P-4320 MINI MALL | 3,511 | 3,149 |
| P-11005 N ENTRY MINI MALL | 93 | 80 |
| P-10207 PENNANTS | 559 | 445 |
| P-11110 GAS STATION | 55 | 53 |
| P-10730A COMMISSARY | 790 | 815 |
| P-4205 INN @ FT DRUM | 5,252 | 5,213 |
| P-6000 NJNG | 358 | 307 |
| P-6001 NJNG | 345 | 592 |
| CREDIT UNION | 71 | 151 |
| P-4515 J.A. JONES | 2,366 | 3,939 |
| P-10762 KEY BANK | 95 | 35 |

FAX TRANSMISSION



2750 S. Wadsworth Blvd.,
Suite C-200
Denver, CO 80227
303/988-2951 Fax 985-2527

Date: **12 January 1996**

Number of pages including cover sheet: 5

Deliver To: Mr. Joe Ogiba
Telemetry Systems Administrator

From: Michael Scholz

Fax No: 1 315 772 9613

EMC No. 1406-012

REMARKS:

☐

Per your
request

☒

For your
review

☐

FAX only, original
will not follow

☒

Please reply

Joe:

We have some questions for your resolution or direction for the evaluation and report we are preparing.

1. When we were at the Post, we inquired about the water usage at the Central Wash Facility (Potable water used to replenish the water cycle). Have you been able to identify the water usage rate for the facility?

2. We would like to know about the water main breaks that have been discovered and fixed under the course of normal maintenance activities in the past two years. Would it be possible to obtain the number of discovered breaks, the size of water main, and, if possible, the location of the water main break?

3. DANC and Ft. Drum Water Rates. In order to calculate the cost of water at Ft. Drum, we are combining a number of factors. Please verify that the attached schedule of rates are correct and if it is appropriate to include with the cost of Ft. Drum's water.

- **Ft. Drum Electrical Charges.** Mr. Gordon Greene in the Utilities Department supplied us with the following charges (attached):
 - Monthly customer charge: \$3,172
 - Demand: \$7.02/kW
 - On Peak consumption: \$0.06196/kWh
 - Off Peak consumption: \$0.05197/kWh
 - Reactive Kilovolt-Ampere (RKVA): \$1.02
 - Bundled charge: \$0.072/kWh (Includes all charges that Ft. Drum pays)

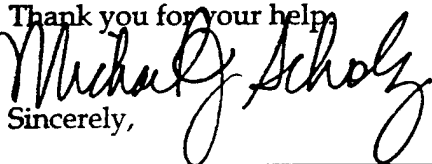
We were directed to use the bundled charge when calculating electrical consumption.

- **Ft. Drum O&M, Chemical Treatment Charges.** Our records do not include maintenance and chlorine charges incurred by Ft. Drum. Could you please verify those charges for us for the past two years?

- **DANC Water Charges.** According to the schedule you provided (attached), Ft. Drum appears to pay \$5.35/kGal for a contracted amount of 1.5 MGD for the period of 4/1/95 to 3/31/96. This charge includes capital, overhead, and O&M charges for both the City of Watertown and DANC. Does Ft. Drum pay for all of these charges or some of them?
- **DANC Electrical Charges.** We were also given a schedule (attached) that gives a estimated cost (\$21,500 in FY94) for pumping water from the DANC facility. Does DANC or Ft. Drum pay this cost? Has this cost been updated for FY1995?
- What items make up the DANC O&M charges?
- What items make up the City O&M charges?
- Does Ft. Drum have chlorine costs associated with the DANC water or the DANC facility? Is that included with the DANC O&M charges?

Any help you can provide is appreciated. I hope to talk to you about this next week, or if more convenient, fax back the answers, if possible, before 19 January. (fax 303-985-2527)

Thank you for your help


Sincerely,

Sep-95

Confidentiality Notice: This facsimile transmission and the materials attached to it are private and confidential. The information contained in the material is privileged and is intended only for the use of the individual(s) or entity(ies) named on this sheet. If you are not the intended recipient, be advised that unauthorized use, disclosure, copying, distribution or the taking of any action in reliance on the contents of this information is strictly prohibited. If you have received this facsimile transmission in error, please immediately notify the sender above to arrange for the return of the transmitted material.

THE ATTACHED SCHEDULE HAS BEEN PROVIDED BY THE
DEVELOPMENT AUTHORITY OF THE NORTH COUNTRY

SCHEDULE SHOWS THE APPROXIMATE COST OF FORT DRUM'S
TRACTED WATER.

THIS SCHEDULE WAS DEVELOPED BASED ON FORT DRUM USING 1.5 MGD.

FOR FURTHER INFORMATION REGARDING THIS SCHEDULE, PLEASE CONTACT
GORDON GREENE OR JEAN HUGHES AT 315-772-4951 (FORT DRUM UTILITIES)

IN FY 94 AN ESTIMATED 265,000 KWH WAS USED TO PUMP WATER;
ESTIMATED COSTS \$21,500.

THIS FIGURE WILL BE REVIEWED AND UPDATED FOR FY 95.

*Who pays this cost? Does DANC, Ft. Drum,
or is it included in the contracted price for
the 1.5 MGD?*

Rates effective 15 Sep 93

EFFECTIVE 27 APR 95

| | | |
|---------|------------------|------------|
| Rate 3A | Customer Charge: | \$3,172.00 |
| | Demand KW: | \$7.02 |
| | On Peak KWH: | \$0.06196 |
| | Off Peak KWH: | \$0.05197 |
| | Refund Credit | 0 |
| | RKVA | \$1.02 |

(Fl. Drum utility office)
Mr. Gordon Greene, directed us to use the bundled
price of \$0.072/KWH, which combines all KW
and KWH costs that Fl. Drum pays to the utility.

THIS SCHEDULE IS FOR INFORMATIONAL PURPOSES ONLY

Development Authority of the North Country
Water Line - Projected to Completion of Capital Payments
Schedule "A"

| Year | City Capital | DANC Capital | DANC Overhead | Combined Capital and Overhead | City O&M | DANC O&M | O&M /KGal. | Guar. MGD | Total /KGal. |
|------------------|--------------|--------------|---------------|-------------------------------|----------|----------|------------|-----------|--------------|
| 4/1/91 - 3/31/92 | 310,694 | 2,532,006 | 75,000 | 2,910,500 | 159,617 | 184,880 | 0.63 | 1.50 | 5.98 |
| 4/1/92 - 3/31/93 | 326,817 | 2,799,108 | 71,000 | 3,196,925 | 176,126 | 307,211 | 0.80 | 1.50 | 6.72 |
| 4/1/93 - 3/31/94 | 314,049 | 2,568,159 | 38,000 | 2,920,208 | 217,379 | 307,685 | 0.96 | 1.50 | 6.29 |
| 4/1/94 - 3/31/95 | 303,960 | 2,295,832 | 84,100 | 2,683,892 | 200,232 | 252,007 | 0.83 | 1.50 | 5.73 |
| 4/1/95 - 3/31/96 | 294,727 | 2,178,970 | 88,305 | 2,503,002 | 210,244 | 154,960 | 0.67 | 1.50 | 5.35 |
| 4/1/96 - 3/31/97 | 285,030 | 2,043,125 | 92,720 | 2,420,875 | 220,756 | 162,708 | 0.70 | 1.50 | 5.12 |
| 4/1/97 - 3/31/98 | 282,610 | 0 | 97,356 | 379,966 | 231,794 | 170,843 | 0.74 | 1.50 | 1.43 |
| 4/1/98 - 3/31/99 | 271,576 | 0 | 102,224 | 373,800 | 243,383 | 179,306 | 0.77 | 1.50 | 1.45 |
| 4/1/99 - 3/31/00 | 256,182 | 0 | 107,335 | 363,517 | 255,552 | 188,355 | 0.81 | 1.50 | 1.47 |
| 4/1/00 - 3/31/01 | 247,212 | 0 | 112,702 | 359,914 | 268,330 | 197,773 | 0.85 | 1.50 | 1.51 |
| 4/1/01 - 3/31/02 | 237,709 | 0 | 118,337 | 356,046 | 281,747 | 207,661 | 0.89 | 1.50 | 1.54 |
| 4/1/02 - 3/31/03 | 233,057 | 0 | 124,254 | 357,311 | 295,834 | 218,044 | 0.94 | 1.50 | 1.59 |
| 4/1/03 - 3/31/04 | 220,004 | 0 | 130,467 | 350,471 | 310,626 | 228,947 | 0.99 | 1.50 | 1.63 |
| 4/1/04 - 3/31/05 | 209,687 | 0 | 136,890 | 346,577 | 328,157 | 240,394 | 1.03 | 1.50 | 1.67 |
| 4/1/05 - 3/31/06 | 199,776 | 0 | 143,840 | 343,616 | 342,485 | 252,414 | 1.09 | 1.50 | 1.71 |
| 4/1/06 - 3/31/07 | 189,519 | 0 | 151,032 | 340,551 | 359,583 | 265,034 | 1.14 | 1.50 | 1.76 |
| 4/1/07 - 3/31/08 | 159,063 | 0 | 158,583 | 317,646 | 377,567 | 278,286 | 1.20 | 1.50 | 1.78 |
| 4/1/08 - 3/31/09 | 150,285 | 0 | 166,512 | 316,797 | 396,446 | 292,200 | 1.28 | 1.50 | 1.84 |
| 4/1/09 - 3/31/10 | 91,496 | 0 | 174,838 | 266,334 | 416,268 | 308,810 | 1.32 | 1.50 | 1.81 |
| 4/1/10 - 3/31/11 | 68,386 | 0 | 183,580 | 251,966 | 437,081 | 322,151 | 1.39 | 1.50 | 1.85 |
| 4/1/11 - 3/31/12 | 35,921 | 0 | 192,759 | 228,680 | 458,935 | 338,258 | 1.46 | 1.50 | 1.87 |
| 4/1/12 - 3/31/13 | 0 | 0 | 202,307 | 202,397 | 481,882 | 355,171 | 1.53 | 1.50 | 1.90 |

DANC Capital and City of Watertown Capital are stated at actual based on amortization schedules as of April 1, 1994.
City O&M, DANC O&M and DANC Overhead each reflect a 5% increase per year beginning in FYE 3/31/96.

THIS SCHEDULE IS FOR INFORMATIONAL PURPOSES ONLY

Previous schedule, received 10/25/95 from H. Davis

FAX



PW

PUBLIC
WORKS

FORT DRUM, NEW YORK

HEADER SHEET

DATE: 16 JAN 96FROM: OPERATIONS & MAINTENANCE DIVISION
PUBLIC WORKS85 FIRST STREET WEST
FORT DRUM NY 13602-5097

Joseph Ogiba

TELEPHONE NO.: (315) 772-3322

FACSIMILE NO.: (315) 772-9613

DSN: 341-

TO: Michael ScholtzTELEPHONE #: (303) 988-2951FAX #: (303) 985-2527NUMBER OF PAGES (INCL. HEADER SHEET) 2MESSAGE: Mike,
A more accurate "Isched. A" is
attached. 1 MAY 96 we will have an update.
Other info is forth coming.
Joe

INITIALS

TIME

SENT: DATE

Development Authority of the North Country
Water Line
Schedule "A"

| Year | City Capital | DARC Capital | DARC Overhead | Combined Capital and Overhead | City O&M | DARC O&M | O&M /KGal. | SAVF. RUB | Total /KGal. |
|------------------|--------------|--------------|---------------|-------------------------------|----------|----------|------------|-----------|--------------|
| 6/1/91 - 3/31/92 | 316,094 | 2,532,005 | 75,000 | 2,919,500 | 159,317 | 184,000 | 0.83 | 1.50 | 1.86 |
| 6/1/92 - 3/31/93 | 327,817 | 2,378,105 | 71,000 | 2,826,922 | 175,136 | 167,211 | 0.78 | 1.50 | 1.72 |
| 6/1/93 - 3/31/94 | 316,049 | 2,566,159 | 38,000 | 2,920,208 | 231,379 | 307,685 | 0.56 | 1.50 | 0.79 |
| 6/1/94 - 3/31/95 | 316,049 | 2,295,832 | 61,100 | 2,493,981 | 217,379 | 252,007 | 0.84 | 1.50 | 1.76 |
| 6/1/95 - 3/31/96 | 316,049 | 2,632,305 | 84,205 | 2,832,559 | 222,073 | 167,431 | 0.71 | 1.50 | 0.75 |
| 6/1/96 - 3/31/97 | 316,049 | 1,535,136 | 84,350 | 1,935,544 | 220,164 | 171,637 | 0.73 | 1.50 | 1.49 |
| 6/1/97 - 3/31/98 | 316,049 | 0 | 90,567 | 404,616 | 231,093 | 175,928 | 0.75 | 1.50 | 1.51 |
| 6/1/98 - 3/31/99 | 316,049 | 0 | 92,431 | 404,800 | 239,944 | 180,326 | 0.77 | 1.50 | 1.51 |
| 6/1/99 - 3/31/00 | 316,049 | 0 | 95,151 | 409,201 | 245,844 | 184,835 | 0.79 | 1.50 | 1.56 |
| 6/1/00 - 3/31/01 | 316,049 | 0 | 97,130 | 411,579 | 252,093 | 189,435 | 0.61 | 1.50 | 1.56 |
| 6/1/01 - 3/31/02 | 316,049 | 0 | 99,968 | 414,019 | 258,195 | 194,192 | 0.83 | 1.50 | 1.61 |
| 6/1/02 - 3/31/03 | 316,049 | 0 | 102,408 | 416,517 | 264,853 | 199,047 | 0.85 | 1.50 | 1.63 |
| 6/1/03 - 3/31/04 | 316,049 | 0 | 105,029 | 419,079 | 271,477 | 204,323 | 0.87 | 1.50 | 1.66 |
| 6/1/04 - 3/31/05 | 316,049 | 0 | 107,655 | 421,704 | 278,263 | 209,123 | 0.89 | 1.50 | 1.69 |
| 6/1/05 - 3/31/06 | 316,049 | 0 | 110,314 | 424,393 | 285,220 | 214,351 | 0.91 | 1.50 | 1.72 |
| 6/1/06 - 3/31/07 | 316,049 | 0 | 113,105 | 427,151 | 292,151 | 219,710 | 0.94 | 1.50 | 1.71 |
| 6/1/07 - 3/31/08 | 316,049 | 0 | 115,931 | 429,982 | 299,659 | 225,203 | 0.96 | 1.50 | 1.69 |
| 6/1/08 - 3/31/09 | 316,049 | 0 | 118,811 | 435,492 | 307,151 | 230,833 | 0.98 | 1.50 | 1.56 |
| 6/1/09 - 3/31/10 | 316,049 | 0 | 121,802 | 438,238 | 314,833 | 236,604 | 1.01 | 1.50 | 1.51 |
| 6/1/10 - 3/31/11 | 316,049 | 0 | 124,867 | 440,902 | 322,709 | 242,519 | 1.03 | 1.50 | 1.31 |
| 6/1/11 - 3/31/12 | 316,049 | 0 | 127,938 | 444,044 | 330,763 | 248,582 | 1.06 | 1.50 | 1.37 |
| 6/1/12 - 3/31/13 | 316,049 | 0 | 131,167 | 447,216 | 339,037 | 254,798 | 1.08 | 1.50 | 1.38 |
| 6/1/13 - 3/31/14 | 316,049 | 0 | 134,466 | 450,416 | 347,313 | 261,165 | 1.11 | 1.50 | 1.38 |

I have estimated the City Capital Pmts. based on the issue date of the debt and current payments.

I have also estimated an annual increase of 2.5% on O&M and DARC Overhead.

THIS SCHEDULE HAS BEEN PREPARED BY SPECIAL REQUEST. IT MAY BE IN VARIANCE WITH CURRENT OR FUTURE SCHEDULE A's

FAX**PW****PUBLIC
WORKS**

FORT DRUM, NEW YORK

HEADER SHEETDATE: 26 JAN 95

FROM: OPERATIONS & MAINTENANCE DIVISION
PUBLIC WORKS Joseph Ogibea
85 FIRST STREET WEST
FORT DRUM NY 13602-5097

TELEPHONE NO.: (315) 772-3322

FACSIMILE NO.: (315) 772-9613

DSN: 341-

TO: Mike SchultzTELEPHONE #: (303) 988-2951FAX #: (303) 985-2527NUMBER OF PAGES (INCL. HEADER SHEET) 6

MESSAGE: _____

INITIALS

TIME

SENT: DATE

We have some questions for your resolution or direction for the evaluation and report we are preparing.

1. When we were at the Post, we inquired about the water usage at the Central Wash Facility (Potable water used to replenish the water cycle). Have you been able to identify the water usage rate for the facility? *Enclosed*

2. We would like to know about the water main breaks that have been discovered and fixed under the course of normal maintenance activities in the past two years. Would it be possible to obtain the number of discovered breaks, the size of water main, and, if possible, the location of the water main break? *No water main breaks.*

3. DANC and Ft. Drum Water Rates. In order to calculate the cost of water at Ft. Drum, we are combining a number of factors. Please verify that the attached schedule of rates are correct and if it is appropriate to include with the cost of Ft. Drum's water.

- Ft. Drum Electrical Charges. Mr. Gordon Greene in the Utilities Department supplied us with the following charges (attached):

- Monthly customer charge: \$3.172
- Demand: \$7.02/kW
- On Peak consumption: \$0.06196/kWh
- Off Peak consumption: \$0.05197/kWh
- Reactive Kilovolt-Ampere (RKVA): \$1.02
- Bundled charge: \$0.072/kWh (Includes all charges that Ft. Drum pays)

We were directed to use the bundled charge when calculating electrical consumption.

- Ft. Drum O&M, Chemical Treatment Charges. Our records do not include maintenance and chlorine charges incurred by Ft. Drum. Could you please verify those charges for us for the past two years?

In so will be available Mon. 29 JAN 96

- DANC Water Charges. According to the schedule you provided (attached), Ft. Drum appears to pay \$5.35/kGal for a contracted amount of 1.3 MGD for the period of 4/1/95 to 3/31/96. This charge includes capital, overhead, and O&M charges for both the City of Watertown and DANC. *Ft. Drum pay for all of these charges*

- DANC Electrical Charges. We were also given a schedule (attached) that gives a estimated cost (\$21,500 in FY94) for pumping water from the DANC facility. Does DANC or Ft. Drum pay this cost? Has this cost been updated for FY1995? *Not yet available.*

- What items make up the DANC O&M charges?

- What items make up the City O&M charges?

- Does Ft. Drum have chlorine costs associated with the DANC water or the DANC facility? *All O&M incurred in Ft. Drum*

that included with the DANC O&M charges

Any help you can provide is appreciated. I hope to talk to you about this next week, or if more convenient, fax back the answers, if possible, before 19 January. (fax 303-985-2527)

Thank you for your help

Sincerely,

Michael G. Scholz

1/31/96 Gpe Oyba 7:48 called term. for O/M
info. Gpe say H. Drum O/M is comprized of 3 items.
Labor, Equip Rental & Supplies \$22,127 FY 1994
\$25,655 FY 1995

Just Chlorine \$ 5550 and is included in 1995

FAX TRANSMISSION



2750 S. Wadsworth Blvd.,
Suite C-200
Denver, CO 80227
303/988-2951 Fax 985-2527

Date: 31 January 1996

Number of pages including cover sheet: 1

Deliver To: Mr. Joe Ogiba
Telemetry Systems Administrator
Ft. Drum, NY
Fax No: (315) 772-9613

From: Michael Scholz
EMC No. 1406.012

REMARKS:

☐

Per your
request

☐

For your
review

☐

FAX only, original
will not follow

☒

Please reply

Joe:

I appreciate your response to our inquiry regarding the operation and maintenance costs for the water system at Ft. Drum. I have a few additional questions:

1. We have determined the operating hours for the 40-hp ground reservoir draining pump from the telemetry data. However, I do not have a record of the flow rate of that pump. Do you happen to know the GPMs of the two ground reservoir pumps (40 hp and 75 hp)?
2. The telemetry system tracks the average flow of water consumed on post (included in Datalog #1 as the variable "FLOW" and "FLW2"). I was curious as to how this value is determined and what elements of the post it represents. For example, are the values for the Central Wash Facility that you just sent to us included in these figures? How about the metered water users such as the PX, Burger King, central plant, etc.?

If you can take a few moments to clarify these questions, I would greatly appreciate it. Thanks for all your help.

Sincerely,

Sep-95

Confidentiality Notice: This facsimile transmission and the materials attached to it are private and confidential. The information contained in the material is privileged and is intended only for the use of the individual(s) or entity(ies) named on this sheet. If you are not the intended recipient, be advised that unauthorized use, disclosure, copying, distribution or the taking of any action in reliance on the contents of this information is strictly prohibited. If you have received this facsimile transmission in error, please immediately notify the sender above to arrange for the return of the transmitted material.

Joe:

I appreciate your response to our inquiry regarding the operation and maintenance costs for the water system at Ft. Drum. I have a few additional questions:

1. We have determined the operating hours for the 40-hp ground reservoir draining pump from the telemetry data. However, I do not have a record of the flow rate of that pump. Do you happen to know the GPMs of the two ground reservoir pumps (40 hp and 75 hp)? *450 GPM*
2. The telemetry system tracks the average flow of water consumed on post (included in Datalog #1 as the variable "FLOW" and "FLW2"). I was curious as to how this value is determined and what elements of the post it represents. For example, are the values for the Central Wash Facility that you just sent to us included in these figures? How about the metered water users such as the FX, Burger King, central plant, etc.?

If you can take a few moments to clarify these questions, I would greatly appreciate it. Thanks for all your help.

Sincerely,

MP.

*Flow = All wells + Tank
incoming flows - ~~the~~ Tank + storage
mediums INCREASE in gals averaged
for the last 15 min.*

02-06

Confidentiality Notice: This facsimile transmission and the materials attached to it are private and confidential. The information contained in the material is privileged and is intended only for the use of the individual(s) or entity(ies) named on this sheet. If you are not the intended recipient, be advised that unauthorized use, disclosure, copying, distribution or the taking of any action in reliance on the contents of this information is strictly prohibited. If you have received this facsimile transmission in error, please immediately notify the sender above to arrange for the return of the transmitted material.

*Flow 2 = same, only averaged
for 1 hr.*

LEGEND FOR TELEMETRY DATA VARIABLES

The files on these disks are the past two and one half years of data collected by Fort Drum's Telemetry system which at this time is monitoring and controlling, mainly, the water system on the post. They are "zipped" using PKZIP and accommodations for hard disk space of 60 MB free space is necessary for all the data.

The remainder of this file attempts to explain the signals in the different data bases that the telemetering system records on the hard drive every five minutes. If there are any questions about this data, call Mr. Joseph Ogiba at (315) 772-3322.

DATALOG 1

"Var" is the variable:

T1LV = Tank 1 level. Located at the water treatment plant.

T2LV = Tank 2 level. Located in the old area on the southern area of the post. No longer in service.

T3LV = Tank 3 level. Located in the new area on the northern area of the post.

WTPF = Water Treatment Plant Flow. GPM output of the water treatment plant

V3V1 = Vault 3 Valve 1. An altitude valve (No. 1) controlled by the telemetering system that fills Tank 3.

DCL2 = Danc Chlorine residual. Chlorine level in ppm of the water as it enters our system from DANC.

DSLS = Danc Start Lead System. The first of two pumps we are able to activate at the Danc pumping station.

DTNK = Danc Tank. Water level at the Danc pumping station.

DFGM = Danc Flow Gallons per Minute. Output flow of water from the Danc pumping station.

DSGS = Danc Start Lag System. The second of two pumps we are able to activate at the Danc pumping station.

RLVL = Reservoir Level. Level of water at the 750,000 gallon emergency reservoir.

RDRN = Reservoir Draining.

RFIL = Reservoir Filling.

V3V2 = Vault 3 Valve 2. An altitude valve (No. 2) controlled by the telemetering system that fills Tank 3.

FPFJ = Fire Pump Facility Jockey pump cycles. Fire Pump Facility Jockey pump cycles (accumulated cycles since 0800 to-day) with a minimum of 0.00 psi and a maximum of 300.00 psi. The site provides one million gallons of water under "higher than normal" pressure to the sprinkler systems and water cannons in facilities at the new runway area. The Jockey pump is a small pump that keeps the pressure in the system at an acceptable safe level.

FLOW = The average flow of water for the past 15 minutes that has been consumed on post.

FLW2 = The average flow of water for the past 1 hour that has been consumed on post.

DATALOG 2

"Var" is the variable:

ST02 through ST12 are the 11 wells on post that suppliment the water from DANC. This data shows when each pump came on and went off.

ARM1 and ARM2 are alarm signals indicating enterance to the computer room and movement therin.

DATALOG 3

The "Var" is the variable:

DFTL = DANC flow total (for the preceeding day 0800-0800) with a minimum of 0.00 gal. and a max of 3000000 gal.. This is the flow from a commercial source in Watertown.

WTPT = Water treatment plant total (for the preceeding day 0800-0800) with a minimum of 0.00 gal. and a max of 2500000 gal.. This is flow from our wells.

FPFJ = Fire Pump Facility Jockey pump cycles per day (for the preceeding day 0800-0800) with a minimum of 0.00 psi and a maximum of 300.00 psi. The site provides one million gallons of water under "higher than normal" pressure to the sprinkler systems and water cannons in facilities at the new runway area. The Jockey pump is a small pump that keeps the pressure in the system at an acceptable level.

SUMMARY - DATALOG #1 VALUES

| Date | Reservoir Draining | Reservoir Filling | DANC First Pump Operation | DANC Second Pump Operation | Vault 3, Valve 1 Operation | Vault 3, Valve 2 Operation | Avg. Flow On Post (gal) | |
|---------------|--------------------|-------------------|---------------------------|----------------------------|----------------------------|----------------------------|-------------------------|-----------|
| Aug-93 | 11,250 | 8,515 | 13,760 | 75 | 20,955 | 0 | 68,157,844 | |
| Sep-93 | 13,465 | 10,325 | 18,685 | 0 | 16,980 | 0 | 61,290,794 | |
| Oct-93 | 9,975 | 7,635 | 17,690 | 0 | 8,255 | 0 | 59,574,456 | |
| Nov-93 | 14,460 | 10,540 | 18,720 | 0 | 8,250 | 5 | 53,432,542 | |
| * Dec-93 | 13,136 | 10,003 | 18,019 | 40 | 6,792 | 0 | 50,798,037 | |
| Jan-94 | 15,050 | 10,835 | 20,870 | 60 | 7,900 | 0 | 63,543,661 | |
| Feb-94 | 13,170 | 10,050 | 16,425 | 150 | 6,260 | 15 | 49,460,309 | |
| Mar-94 | 13,705 | 12,210 | 21,145 | 40 | 7,150 | 10 | 63,570,191 | |
| Apr-94 | 15,895 | 14,055 | 18,300 | 0 | 5,900 | 0 | 53,618,772 | |
| May-94 | 18,545 | 16,650 | 20,595 | 25 | 17,735 | 35 | 56,948,910 | |
| Jun-94 | 15,565 | 13,635 | 21,150 | 40 | 9,405 | 5 | 67,565,334 | |
| Jul-94 | 15,385 | 13,400 | 21,025 | 20 | 9,450 | 15 | 66,056,844 | |
| Total (Min.) | 169,601 | 137,853 | 226,384 | 450 | 125,032 | 85 | 714,017,694 | (gal) |
| Total (Hours) | 2,827 | 2,298 | 3,773 | 8 | 2,084 | 1 | 714,018 | (kgal/yr) |
| Aug-94 | 15,700 | 14,505 | 22,545 | 275 | 9,615 | 0 | 65,157,060 | |
| Sep-94 | 16,895 | 14,875 | 21,410 | 0 | 7,285 | 0 | 54,783,694 | |
| Oct-94 | 18,395 | 16,250 | 18,155 | 50 | 5,110 | 0 | 48,043,852 | |
| ** Nov-94 | 18,533 | 16,174 | 16,464 | 0 | 5,297 | 5 | 44,843,294 | |
| Dec-94 | 15,850 | 14,370 | 21,200 | 125 | 6,025 | 0 | 57,702,973 | |
| Jan-95 | 0 | 300 | 21,360 | 110 | 7,065 | 0 | 64,111,233 | |
| Feb-95 | 8,375 | 12,950 | 18,695 | 0 | 6,260 | 160 | 55,129,641 | |
| Mar-95 | 8,595 | 14,095 | 21,125 | 20 | 7,235 | 0 | 59,888,010 | |
| *** Apr-95 | 15,895 | 14,055 | 18,300 | 0 | 5,900 | 0 | 53,618,772 | |
| May-95 | 9,970 | 15,945 | 20,830 | 100 | 8,190 | 0 | 67,528,936 | |
| Jun-94 | 8,200 | 11,300 | 21,890 | 9,675 | 13,575 | 0 | 83,657,862 | |
| Jul-95 | 7,690 | 4,795 | 19,140 | 930 | 16,440 | 3,135 | 80,539,244 | |
| Total (Min.) | 144,098 | 149,614 | 241,114 | 11,285 | 97,997 | 3,300 | 735,004,571 | (gal) |
| Total (Hours) | 2,402 | 2,494 | 4,019 | 188 | 1,633 | 55 | 735,005 | (kgal/yr) |
| Avg. (Min.) | 156,850 | 143,734 | 233,749 | 5,868 | 111,515 | 1,693 | 724,511,133 | (gal) |
| Avg. (Hours) | 2,614 | 2,396 | 3,896 | 98 | 1,859 | 28 | 724,511 | (kgal/yr) |

Annual operating hours as recorded by telemetry system.

*Note: Telemetry data was incomplete, covering from December 1 to December 28 (06:28) only. Value was extrapolated.

**Note: Telemetry data was incomplete, covering from November 1 to November 23 (09:48) only. Value was extrapolated.

***Note: Telemetry data received or April 1995 was in unreadable format. Data for April 1994 was substituted.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - AUGUST 1993

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 20:58:41 | 1418.59 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:03:41 | 1046.75 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:08:41 | 1046.75 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:13:41 | 1046.75 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:18:41 | 1362.25 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:23:41 | 1362.25 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:28:41 | 1362.25 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:33:41 | 895.581 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:38:41 | 895.581 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:43:41 | 895.581 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:48:41 | 1544.42 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:53:41 | 1544.42 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 21:58:41 | 1544.42 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| 22:03:41 | 1365.36 | 0 | 0 | 0 | 0 | 1 | 0 | 5 |
| 22:08:41 | 1365.36 | 0 | 0 | 0 | 0 | 1 | 0 | 5 |
| 22:13:41 | 1365.36 | 0 | 0 | 0 | 0 | 1 | 0 | 5 |
| 22:18:41 | 1071.93 | 0 | 0 | 0 | 0 | 1 | 0 | 5 |
| 22:23:41 | 1071.93 | 0 | 0 | 0 | 0 | 1 | 0 | 4.984 |
| 22:28:41 | 1071.93 | 0 | 0 | 0 | 0 | 1 | 0 | 4.695 |
| 22:33:41 | 1391.69 | 0 | 0 | 0 | 0 | 0 | 0 | 4.581 |
| 22:38:41 | 1391.69 | 0 | 0 | 0 | 0 | 0 | 0 | 4.329 |
| 22:43:41 | 1391.69 | 0 | 0 | 0 | 0 | 0 | 0 | 4.174 |
| 22:48:41 | 1207.51 | 0 | 0 | 0 | 0 | 0 | 0 | 4.141 |
| 22:53:41 | 1207.51 | 0 | 0 | 0 | 0 | 0 | 0 | 4.02 |
| 22:58:41 | 1207.51 | 0 | 0 | 0 | 0 | 0 | 0 | 3.957 |
| 23:03:41 | 1418.15 | 0 | 0 | 0 | 0 | 0 | 0 | 3.945 |
| 23:08:41 | 1418.15 | 0 | 0 | 0 | 0 | 0 | 0 | 3.986 |
| 23:13:41 | 1418.15 | 0 | 0 | 0 | 0 | 0 | 0 | 4.044 |
| 23:18:41 | 897.191 | 0 | 0 | 0 | 0 | 0 | 0 | 4.08 |
| 23:23:41 | 897.191 | 0 | 0 | 0 | 0 | 0 | 0 | 4.154 |
| 23:28:41 | 897.191 | 0 | 0 | 0 | 0 | 0 | 1 | 4.157 |
| 23:33:41 | 1011.69 | 0 | 0 | 0 | 0 | 0 | 1 | 4.204 |
| 23:38:41 | 1011.69 | 0 | 0 | 0 | 0 | 0 | 0 | 4.29 |
| 23:43:41 | 1011.69 | 0 | 0 | 0 | 0 | 0 | 0 | 4.219 |
| 23:48:41 | 1116.73 | 0 | 0 | 0 | 0 | 0 | 0 | 4.333 |
| 23:53:41 | 1116.73 | 0 | 0 | 0 | 0 | 0 | 0 | 4.386 |
| 23:58:41 | 1116.73 | 0 | 0 | 0 | 0 | 0 | 0 | 4.413 |
| Segments | 13,631,569 | 4,191 | 0 | 3,952 | 15 | 2,250 | 1,703 | 0.744 |
| Sum (gpm) | 4,543,856 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 68,157,844 | - | - | - | - | - | - | 2.689 |
| Minutes (5x) | | 20,955 | 0 | 19,760 | 75 | 11,250 | 8,515 | |
| Hours | | 349 | 0 | 329 | 1 | 188 | 142 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - SEPTEMBER 1993

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 21:33:33 | 1343.92 | 0 | 0 | 0 | 0 | 1 | 0 | 4.42 |
| 21:38:33 | 1343.92 | 0 | 0 | 0 | 0 | 1 | 0 | 4.353 |
| 21:43:33 | 1343.92 | 0 | 0 | 0 | 0 | 1 | 0 | 4.385 |
| 21:48:33 | 1336.27 | 0 | 0 | 0 | 0 | 1 | 0 | 4.264 |
| 21:53:33 | 1336.27 | 0 | 0 | 0 | 0 | 1 | 0 | 4.322 |
| 21:58:33 | 1336.27 | 0 | 0 | 0 | 0 | 1 | 0 | 4.326 |
| 22:03:33 | 1254.78 | 0 | 0 | 0 | 0 | 1 | 0 | 4.193 |
| 22:08:33 | 1254.78 | 0 | 0 | 0 | 0 | 1 | 0 | 4.188 |
| 22:13:33 | 1254.78 | 0 | 0 | 0 | 0 | 1 | 0 | 4.189 |
| 22:18:33 | 1253.71 | 0 | 0 | 0 | 0 | 1 | 0 | 4.282 |
| 22:23:33 | 1253.71 | 0 | 0 | 0 | 0 | 1 | 0 | 4.295 |
| 22:28:33 | 1253.71 | 0 | 0 | 0 | 0 | 1 | 0 | 4.335 |
| 22:33:33 | 950.279 | 0 | 0 | 0 | 0 | 1 | 0 | 4.318 |
| 22:38:33 | 950.279 | 0 | 0 | 0 | 0 | 1 | 0 | 4.313 |
| 22:43:33 | 950.279 | 0 | 0 | 0 | 0 | 1 | 0 | 4.335 |
| 22:48:33 | 909.43 | 0 | 0 | 0 | 0 | 0 | 0 | 4.388 |
| 22:53:33 | 909.43 | 0 | 0 | 0 | 0 | 1 | 0 | 4.423 |
| 22:58:33 | 909.43 | 0 | 0 | 0 | 0 | 1 | 0 | 4.382 |
| 23:03:33 | 1251.98 | 0 | 0 | 0 | 0 | 1 | 0 | 4.382 |
| 23:08:33 | 1251.98 | 0 | 0 | 0 | 0 | 1 | 0 | 4.513 |
| 23:13:33 | 1251.98 | 0 | 0 | 0 | 0 | 1 | 0 | 4.48 |
| 23:18:33 | 719.998 | 0 | 0 | 0 | 0 | 0 | 0 | 4.663 |
| 23:23:33 | 719.998 | 0 | 0 | 0 | 0 | 0 | 0 | 4.768 |
| 23:28:33 | 719.998 | 0 | 0 | 0 | 0 | 1 | 0 | 4.76 |
| 23:33:33 | 845.92 | 0 | 0 | 0 | 0 | 1 | 0 | 4.804 |
| 23:38:33 | 845.92 | 0 | 0 | 0 | 0 | 1 | 0 | 4.882 |
| 23:43:33 | 845.92 | 0 | 0 | 0 | 0 | 1 | 0 | 4.894 |
| 23:48:33 | 605.073 | 0 | 0 | 0 | 0 | 1 | 0 | 4.937 |
| 23:53:33 | 605.073 | 0 | 0 | 0 | 0 | 1 | 0 | 4.992 |
| 23:58:33 | 605.073 | 0 | 0 | 0 | 0 | 1 | 0 | 4.989 |
| Segments | 12,258,159 | 3,396 | 0 | 3,737 | 0 | 2,693 | 2,065 | 0.000 |
| Sum (gpm) | 4,086,053 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 61,290,794 | - | - | - | - | - | - | 3.898 |
| Minutes (5x) | | 16,980 | 0 | 18,685 | 0 | 13,465 | 10,325 | |
| Hours | | 283 | 0 | 311 | 0 | 224 | 172 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - OCTOBER 1993

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 23:24:00 | 1704.93 | 0 | 0 | 0 | 0 | 0 | 0 | 2.752 |
| 23:29:00 | 1704.93 | 0 | 0 | 0 | 0 | 0 | 0 | 2.727 |
| 23:34:00 | 1281.23 | 0 | 0 | 0 | 0 | 0 | 0 | 2.732 |
| 23:39:00 | 1281.23 | 0 | 0 | 0 | 0 | 0 | 0 | 2.726 |
| 23:44:00 | 1281.23 | 0 | 0 | 0 | 0 | 0 | 0 | 2.696 |
| 23:49:00 | 920.991 | 0 | 0 | 0 | 0 | 0 | 0 | 2.707 |
| 23:54:00 | 920.991 | 0 | 0 | 0 | 0 | 0 | 0 | 2.672 |
| 23:59:00 | 920.991 | 0 | 0 | 0 | 0 | 0 | 0 | 2.672 |
| Segments | 11,914,891 | 1,651 | 0 | 3,538 | 0 | 1,995 | 1,527 | 0.000 |
| Sum (gpm) | 3,971,630 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 59,574,456 | - | - | - | - | - | - | 2.328 |
| Minutes (5x) | | 8,255 | 0 | 17,690 | 0 | 9,975 | 7,635 | |
| Hours | | 138 | 0 | 295 | 0 | 166 | 127 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - NOVEMBER 1993

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 22:41:31 | 1696.69 | 0 | 0 | 0 | 0 | 0 | 0 | 1.908 |
| 22:46:31 | 1004.98 | 0 | 0 | 0 | 0 | 0 | 0 | 2.014 |
| 22:51:31 | 1004.98 | 0 | 0 | 0 | 0 | 0 | 0 | 2.041 |
| 22:56:31 | 1004.98 | 0 | 0 | 0 | 0 | 0 | 0 | 2.06 |
| 23:01:31 | 1136.07 | 0 | 0 | 0 | 0 | 0 | 0 | 2.081 |
| 23:06:31 | 1136.07 | 0 | 0 | 0 | 0 | 0 | 0 | 1.823 |
| 23:11:31 | 1136.07 | 0 | 0 | 0 | 0 | 0 | 0 | 1.877 |
| 23:16:31 | 1278.65 | 0 | 0 | 0 | 0 | 0 | 0 | 1.97 |
| 23:21:31 | 1278.65 | 0 | 0 | 0 | 0 | 0 | 0 | 2.035 |
| 23:26:31 | 1278.65 | 0 | 0 | 0 | 0 | 0 | 0 | 2.073 |
| 23:31:31 | 678.023 | 0 | 0 | 1 | 0 | 0 | 0 | 2.105 |
| 23:36:31 | 678.023 | 0 | 0 | 1 | 0 | 0 | 1 | 1.935 |
| 23:41:31 | 678.023 | 0 | 0 | 1 | 0 | 0 | 1 | 2.049 |
| 23:46:31 | 1788.02 | 0 | 0 | 1 | 0 | 0 | 1 | 2.086 |
| 23:51:31 | 1788.02 | 0 | 0 | 1 | 0 | 0 | 1 | 2.066 |
| 23:56:31 | 1788.02 | 0 | 0 | 1 | 0 | 0 | 1 | 2.096 |
| Segments | 10,686,508 | 1,650 | 1 | 3,744 | 0 | 2,892 | 2,108 | 0.000 |
| Sum (gpm) | 3,562,169 | - | - | - | - | - | - | 3.181 |
| (gal) (15x) | 53,432,542 | - | - | - | - | - | - | 1.918 |
| Minutes (5x) | | 8,250 | 5 | 18,720 | 0 | 14,460 | 10,540 | |
| Hours | | 138 | 0 | 312 | 0 | 241 | 176 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - DECEMBER 1993

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 3:22:55 | 1594.69 | 0 | 0 | 1 | 0 | 0 | 0 | 1.896 |
| 3:27:55 | 1594.69 | 0 | 0 | 1 | 0 | 0 | 0 | 1.896 |
| 3:32:55 | 1365.94 | 0 | 0 | 1 | 0 | 0 | 1 | 1.893 |
| 3:37:55 | 1365.94 | 0 | 0 | 1 | 0 | 0 | 1 | 1.921 |
| 3:42:55 | 1365.94 | 0 | 0 | 1 | 0 | 0 | 1 | 1.915 |
| 3:47:55 | 1190.35 | 0 | 0 | 1 | 0 | 0 | 1 | 1.898 |
| 3:52:55 | 1190.35 | 0 | 0 | 1 | 0 | 0 | 1 | 1.916 |
| 3:57:55 | 1190.35 | 0 | 0 | 1 | 0 | 0 | 1 | 1.905 |
| 4:02:55 | 1536.81 | 0 | 0 | 1 | 0 | 0 | 1 | 1.931 |
| 4:07:55 | 1536.81 | 0 | 0 | 1 | 0 | 0 | 1 | 1.952 |
| 4:12:55 | 1536.81 | 0 | 0 | 0 | 0 | 0 | 1 | 1.925 |
| 4:17:55 | 1338.9 | 0 | 0 | 0 | 0 | 0 | 1 | 1.877 |
| 4:22:55 | 1338.9 | 0 | 0 | 0 | 0 | 0 | 1 | 1.931 |
| 4:27:55 | 1338.9 | 0 | 0 | 0 | 0 | 0 | 1 | 1.941 |
| 4:32:55 | 985.962 | 0 | 0 | 0 | 0 | 0 | 0 | 1.955 |
| 4:37:55 | 985.962 | 0 | 0 | 0 | 0 | 0 | 0 | 1.971 |
| 4:42:55 | 985.962 | 0 | 0 | 0 | 0 | 0 | 0 | 1.923 |
| 4:47:55 | 1533.08 | 0 | 0 | 0 | 0 | 0 | 0 | 1.936 |
| 4:52:55 | 1533.08 | 0 | 0 | 0 | 0 | 0 | 0 | 1.943 |
| 4:57:55 | 1533.08 | 0 | 0 | 0 | 0 | 1 | 0 | 1.943 |
| 5:02:55 | 1126.14 | 0 | 0 | 0 | 0 | 1 | 0 | 1.92 |
| 5:07:55 | 1126.14 | 0 | 0 | 0 | 0 | 1 | 0 | 1.931 |
| 5:12:55 | 1126.14 | 0 | 0 | 0 | 0 | 1 | 0 | 1.937 |
| 5:17:55 | 1196.72 | 0 | 0 | 0 | 0 | 1 | 0 | 1.913 |
| 5:22:55 | 1196.72 | 0 | 0 | 0 | 0 | 1 | 0 | 1.931 |
| 5:27:55 | 1196.72 | 0 | 0 | 0 | 0 | 1 | 0 | 1.877 |
| 5:32:55 | 1225.53 | 0 | 0 | 0 | 0 | 1 | 0 | 1.901 |
| 5:37:55 | 1225.53 | 0 | 0 | 0 | 0 | 1 | 0 | 1.858 |
| 5:42:55 | 1225.53 | 0 | 0 | 0 | 0 | 1 | 0 | 1.911 |
| 5:47:55 | 1393.34 | 0 | 0 | 0 | 0 | 1 | 0 | 1.886 |
| 5:52:55 | 1393.34 | 0 | 0 | 0 | 0 | 1 | 0 | 1.877 |
| 5:57:55 | 1393.34 | 0 | 0 | 0 | 0 | 1 | 0 | 1.908 |
| 6:02:55 | 1409.98 | 0 | 0 | 0 | 0 | 1 | 0 | 1.911 |
| 6:07:55 | 1409.98 | 0 | 0 | 0 | 0 | 1 | 0 | 1.903 |
| 6:12:55 | 1409.98 | 0 | 0 | 0 | 0 | 1 | 0 | 1.861 |
| 6:17:55 | 1874.16 | 0 | 0 | 0 | 0 | 0 | 0 | 1.931 |
| 6:22:55 | 1874.16 | 0 | 0 | 0 | 0 | 0 | 0 | 1.905 |
| 6:27:55 | 1874.16 | 0 | 0 | 0 | 0 | 0 | 0 | 1.909 |
| Segments | 9,176,420 | 1,227 | 0 | 3,255 | 7 | 2,373 | 1,807 | 0.000 |
| Sum (gpm) | 3,058,807 | - | - | - | - | - | - | 3.358 |
| (gal) (15x) | 45,882,098 | - | - | - | - | - | - | 1.818 |
| Minutes (5x) | | 6,135 | 0 | 16,275 | 35 | 11,865 | 9,035 | |
| Hours | | 102 | 0 | 271 | 1 | 198 | 151 | |

Min.
Max.
Avg.

*Note: Telemetry data is incomplete and only covers from December 1 to December 28 (06:28)

Assume data is extrapolated to 31 days:

| | | | | | | |
|------------|--------|--------|--------|--------|--------|--------|
| 50,798,037 | 6,792 | 0 | 18,019 | 39 | 13,136 | 10,003 |
| (gal) | (min.) | (min.) | (min.) | (min.) | (min.) | (min.) |

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - JANUARY 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 22:16:25 | 1751.32 | 0 | 0 | 0 | 0 | 0 | 0 | 1.183 |
| 22:21:25 | 1751.32 | 0 | 0 | 0 | 0 | 0 | 0 | 1.165 |
| 22:26:25 | 1751.32 | 0 | 0 | 0 | 0 | 0 | 0 | 1.176 |
| 22:31:25 | 1405.32 | 0 | 0 | 0 | 0 | 0 | 0 | 1.161 |
| 22:36:25 | 1405.32 | 0 | 0 | 0 | 0 | 0 | 0 | 1.16 |
| 22:41:25 | 1405.32 | 1 | 0 | 0 | 0 | 0 | 0 | 1.184 |
| 22:46:25 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1.113 |
| 22:51:25 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1.156 |
| 22:56:25 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1.145 |
| 23:01:25 | 527.356 | 1 | 0 | 0 | 0 | 1 | 0 | 1.175 |
| 23:06:25 | 527.356 | 1 | 0 | 0 | 0 | 1 | 0 | 1.121 |
| 23:11:25 | 527.356 | 1 | 0 | 0 | 0 | 1 | 0 | 1.159 |
| 23:16:25 | 668.138 | 1 | 0 | 0 | 0 | 1 | 0 | 1.168 |
| 23:21:25 | 668.138 | 1 | 0 | 0 | 0 | 1 | 0 | 1.151 |
| 23:26:25 | 668.138 | 0 | 0 | 0 | 0 | 1 | 0 | 1.131 |
| 23:31:25 | 2728.86 | 0 | 0 | 0 | 0 | 1 | 0 | 1.132 |
| 23:36:25 | 2728.86 | 0 | 0 | 0 | 0 | 1 | 0 | 1.125 |
| 23:41:25 | 2728.86 | 0 | 0 | 0 | 0 | 1 | 0 | 1.121 |
| 23:46:25 | 1612.48 | 0 | 0 | 0 | 0 | 1 | 0 | 1.118 |
| 23:51:25 | 1612.48 | 0 | 0 | 0 | 0 | 1 | 0 | 1.137 |
| 23:56:25 | 1612.48 | 0 | 0 | 0 | 0 | 0 | 0 | 1.129 |
| Segments | 12,708,732 | 1,580 | 0 | 4,174 | 12 | 3,010 | 2,167 | 0.720 |
| Sum (gpm) | 4,236,244 | - | - | - | - | - | - | 2.495 |
| (gal) (15x) | 63,543,661 | - | - | - | - | - | - | 1.689 |
| Minutes (5x) | | 7,900 | 0 | 20,870 | 60 | 15,050 | 10,835 | |
| Hours | | 132 | 0 | 348 | 1 | 251 | 181 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - FEBRUARY 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 20:34:20 | 1420.91 | 0 | 0 | 0 | 0 | 1 | 0 | 1.592 |
| 20:39:20 | 1420.91 | 0 | 0 | 0 | 0 | 1 | 0 | 1.602 |
| 20:44:20 | 1420.91 | 0 | 0 | 0 | 0 | 1 | 0 | 1.587 |
| 20:49:20 | 1300.8 | 0 | 0 | 0 | 0 | 1 | 0 | 1.564 |
| 20:54:20 | 1300.8 | 0 | 0 | 0 | 0 | 1 | 0 | 1.583 |
| 20:59:20 | 1300.8 | 1 | 0 | 1 | 0 | 1 | 0 | 1.536 |
| 21:04:20 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1.579 |
| 21:09:20 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1.6 |
| 21:14:20 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1.571 |
| 21:19:20 | 635.934 | 1 | 0 | 1 | 0 | 1 | 0 | 1.583 |
| 21:24:20 | 635.934 | 1 | 0 | 1 | 0 | 1 | 0 | 1.614 |
| 21:29:20 | 635.934 | 1 | 0 | 1 | 0 | 1 | 0 | 1.59 |
| 21:34:20 | 949.127 | 1 | 0 | 1 | 0 | 1 | 0 | 1.576 |
| 21:39:20 | 949.127 | 1 | 0 | 1 | 0 | 1 | 0 | 1.561 |
| 21:44:20 | 949.127 | 0 | 0 | 1 | 0 | 1 | 0 | 1.559 |
| 21:49:20 | 3754.75 | 0 | 0 | 1 | 0 | 1 | 0 | 1.623 |
| 21:54:20 | 3754.75 | 0 | 0 | 1 | 0 | 1 | 0 | 1.634 |
| 21:59:20 | 3754.75 | 0 | 0 | 1 | 0 | 1 | 0 | 1.639 |
| 22:04:20 | 1334.96 | 0 | 0 | 1 | 0 | 1 | 0 | 1.649 |
| 22:09:20 | 1334.96 | 0 | 0 | 1 | 0 | 1 | 0 | 1.665 |
| 22:14:20 | 1334.96 | 0 | 0 | 1 | 0 | 1 | 0 | 1.696 |
| 22:19:20 | 1543.66 | 0 | 0 | 1 | 0 | 1 | 0 | 1.685 |
| 22:24:20 | 1543.66 | 0 | 0 | 1 | 0 | 1 | 0 | 1.684 |
| 22:29:20 | 1543.66 | 0 | 0 | 1 | 0 | 1 | 0 | 1.684 |
| 22:34:20 | 1382.46 | 0 | 0 | 1 | 0 | 1 | 0 | 1.697 |
| 22:39:20 | 1382.46 | 0 | 0 | 0 | 0 | 0 | 1 | 1.668 |
| 22:44:20 | 1382.46 | 0 | 0 | 0 | 0 | 0 | 1 | 1.661 |
| 22:49:20 | 1152.51 | 0 | 0 | 0 | 0 | 0 | 1 | 1.665 |
| 22:54:20 | 1152.51 | 0 | 0 | 0 | 0 | 0 | 1 | 1.66 |
| 22:59:20 | 1152.51 | 0 | 0 | 0 | 0 | 0 | 0 | 1.602 |
| 23:04:20 | 873.049 | 0 | 0 | 0 | 0 | 0 | 0 | 1.647 |
| 23:09:20 | 873.049 | 0 | 0 | 0 | 0 | 0 | 0 | 1.622 |
| 23:14:20 | 873.049 | 0 | 0 | 0 | 0 | 0 | 0 | 1.614 |
| 23:19:20 | 1319.93 | 0 | 0 | 0 | 0 | 0 | 0 | 1.621 |
| 23:24:20 | 1319.93 | 0 | 0 | 0 | 0 | 0 | 0 | 1.629 |
| 23:29:20 | 1319.93 | 0 | 0 | 0 | 0 | 0 | 0 | 1.651 |
| 23:34:20 | 1009.82 | 0 | 0 | 0 | 0 | 0 | 0 | 1.629 |
| 23:39:20 | 1009.82 | 0 | 0 | 0 | 0 | 0 | 0 | 1.598 |
| 23:44:20 | 1009.82 | 0 | 0 | 0 | 0 | 0 | 0 | 1.622 |
| 23:49:20 | 913.785 | 0 | 0 | 0 | 0 | 0 | 0 | 1.619 |
| 23:54:20 | 913.785 | 0 | 0 | 1 | 0 | 0 | 0 | 1.595 |
| 23:59:20 | 913.785 | 0 | 0 | 1 | 0 | 0 | 1 | 1.717 |
| Segments | 9,892,062 | 1,252 | 3 | 3,285 | 30 | 2,634 | 2,010 | 0.000 |
| Sum (gpm) | 3,297,354 | - | - | - | - | - | - | 2.108 |
| (gal) (15x) | 49,460,309 | - | - | - | - | - | - | 1.503 |
| Minutes (5x) | | 6,260 | 15 | 16,425 | 150 | 13,170 | 10,050 | |
| Hours | | 104 | 0 | 274 | 3 | 220 | 168 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - MARCH 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 22:05:28 | 1221.79 | 0 | 0 | 0 | 0 | 1 | 0 | 1.647 |
| 22:10:28 | 1221.79 | 0 | 0 | 0 | 0 | 1 | 0 | 1.63 |
| 22:15:28 | 1576.26 | 0 | 0 | 0 | 0 | 1 | 0 | 1.637 |
| 22:20:28 | 1576.26 | 0 | 0 | 0 | 0 | 1 | 0 | 1.627 |
| 22:25:28 | 1576.26 | 0 | 0 | 0 | 0 | 1 | 0 | 1.649 |
| 22:30:28 | 1225.53 | 0 | 0 | 0 | 0 | 0 | 0 | 1.645 |
| 22:35:28 | 1225.53 | 0 | 0 | 0 | 0 | 0 | 0 | 1.634 |
| 22:40:28 | 1225.53 | 0 | 0 | 0 | 0 | 0 | 0 | 1.635 |
| 22:45:28 | 1228.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.665 |
| 22:50:28 | 1228.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.642 |
| 22:55:28 | 1228.01 | 1 | 0 | 1 | 0 | 0 | 0 | 1.654 |
| 23:00:28 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1.685 |
| 23:05:28 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1.655 |
| 23:10:28 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1.655 |
| 23:15:28 | 72.962 | 1 | 0 | 1 | 0 | 1 | 0 | 1.668 |
| 23:20:28 | 72.962 | 1 | 0 | 1 | 0 | 1 | 0 | 1.664 |
| 23:25:28 | 72.962 | 1 | 0 | 1 | 0 | 1 | 0 | 1.664 |
| 23:30:28 | 4000 | 1 | 0 | 1 | 0 | 1 | 0 | 1.693 |
| 23:35:28 | 4000 | 1 | 0 | 0 | 0 | 0 | 0 | 1.658 |
| 23:40:28 | 4000 | 0 | 0 | 0 | 0 | 0 | 0 | 1.668 |
| 23:45:28 | 1321.62 | 0 | 0 | 0 | 0 | 0 | 0 | 1.649 |
| 23:50:28 | 1321.62 | 0 | 0 | 0 | 0 | 0 | 0 | 1.63 |
| 23:55:28 | 1321.62 | 0 | 0 | 0 | 0 | 0 | 0 | 1.657 |
| Segments | 12,714,038 | 1,430 | 2 | 4,229 | 8 | 2,741 | 2,442 | 0.000 |
| Sum (gpm) | 4,238,013 | - | - | - | - | - | - | 2.107 |
| (gal) (15x) | 63,570,191 | - | - | - | - | - | - | 1.497 |
| Minutes (5x) | | 7,150 | 10 | 21,145 | 40 | 13,705 | 12,210 | |
| Hours | | 119 | 0 | 352 | 1 | 228 | 204 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - APRIL 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 21:41:07 | 3248.91 | 0 | 0 | 1 | 0 | 1 | 0 | 1.713 |
| 21:46:07 | 1008.42 | 0 | 0 | 1 | 0 | 1 | 0 | 1.7 |
| 21:51:07 | 1008.42 | 0 | 0 | 1 | 0 | 1 | 0 | 1.688 |
| 21:56:07 | 1008.42 | 0 | 0 | 1 | 0 | 1 | 0 | 1.678 |
| 22:01:07 | 1814.95 | 0 | 0 | 0 | 0 | 1 | 0 | 1.692 |
| 22:06:07 | 1814.95 | 0 | 0 | 0 | 0 | 0 | 1 | 1.674 |
| 22:11:07 | 1814.95 | 0 | 0 | 0 | 0 | 0 | 1 | 1.678 |
| 22:16:07 | 983.475 | 0 | 0 | 0 | 0 | 0 | 1 | 1.669 |
| 22:21:07 | 983.475 | 0 | 0 | 0 | 0 | 0 | 1 | 1.658 |
| 22:26:07 | 983.475 | 0 | 0 | 0 | 0 | 0 | 1 | 1.686 |
| 22:31:07 | 1258.3 | 0 | 0 | 0 | 0 | 0 | 1 | 1.664 |
| 22:36:07 | 1258.3 | 0 | 0 | 0 | 0 | 0 | 1 | 1.654 |
| 22:41:07 | 1258.3 | 0 | 0 | 0 | 0 | 1 | 0 | 1.662 |
| 22:46:07 | 982.199 | 0 | 0 | 0 | 0 | 1 | 0 | 1.669 |
| 22:51:07 | 982.199 | 0 | 0 | 0 | 0 | 1 | 0 | 1.653 |
| 22:56:07 | 982.199 | 0 | 0 | 0 | 0 | 1 | 0 | 1.666 |
| 23:01:07 | 856.315 | 0 | 0 | 0 | 0 | 1 | 0 | 1.662 |
| 23:06:07 | 856.315 | 0 | 0 | 0 | 0 | 1 | 0 | 1.676 |
| 23:11:07 | 856.315 | 0 | 0 | 0 | 0 | 1 | 0 | 1.676 |
| 23:16:07 | 950.665 | 0 | 0 | 0 | 0 | 1 | 0 | 1.658 |
| 23:21:07 | 950.665 | 0 | 0 | 0 | 0 | 0 | 0 | 1.661 |
| 23:26:07 | 950.665 | 1 | 0 | 1 | 0 | 0 | 1 | 1.672 |
| 23:31:07 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.643 |
| 23:36:07 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.65 |
| 23:41:07 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.66 |
| 23:46:07 | 2263.82 | 1 | 0 | 1 | 0 | 1 | 0 | 1.649 |
| 23:51:07 | 2263.82 | 0 | 0 | 1 | 0 | 1 | 0 | 1.649 |
| 23:56:07 | 2263.82 | 0 | 0 | 1 | 0 | 1 | 0 | 1.642 |
| Segments | 10,723,754 | 1,180 | 0 | 3,660 | 0 | 3,179 | 2,811 | 0.000 |
| Sum (gpm) | 3,574,585 | - | - | - | - | - | - | 2.066 |
| (gal) (15x) | 53,618,772 | - | - | - | - | - | - | 1.317 |
| Minutes (5x) | | 5,900 | 0 | 18,300 | 0 | 15,895 | 14,055 | |
| Hours | | 98 | 0 | 305 | 0 | 265 | 234 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - MAY 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 23:32:07 | 1012.48 | 0 | 0 | 0 | 0 | 1 | 0 | 4.325 |
| 23:37:07 | 1012.48 | 0 | 0 | 0 | 0 | 1 | 0 | 4.233 |
| 23:42:07 | 1012.48 | 0 | 0 | 0 | 0 | 1 | 0 | 4.189 |
| 23:47:07 | 977.827 | 0 | 0 | 0 | 0 | 1 | 0 | 4.229 |
| 23:52:07 | 977.827 | 0 | 0 | 0 | 0 | 1 | 0 | 4.236 |
| 23:57:07 | 977.827 | 0 | 0 | 0 | 0 | 0 | 1 | 4.211 |
| Segments | 11,389,782 | 3,546 | 6 | 4,118 | 4 | 3,708 | 3,329 | 0.726 |
| Sum (gpm) | 3,796,594 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 56,948,910 | - | - | - | - | - | - | 2.097 |
| Minutes (5x) | | 17,730 | 30 | 20,590 | 20 | 18,540 | 16,645 | |
| Hours | | 296 | 1 | 343 | 0 | 309 | 277 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - JUNE 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 23:31:24 | 1225.93 | 0 | 0 | 1 | 0 | 0 | 0 | 1.069 |
| 23:36:24 | 1225.93 | 0 | 0 | 1 | 0 | 0 | 0 | 1.088 |
| 23:41:24 | 1225.93 | 0 | 0 | 0 | 0 | 0 | 0 | 1.106 |
| 23:46:24 | 1465.03 | 0 | 0 | 0 | 0 | 0 | 0 | 1.102 |
| 23:51:24 | 1465.03 | 0 | 0 | 0 | 0 | 0 | 0 | 1.096 |
| 23:56:24 | 1465.03 | 0 | 0 | 0 | 0 | 0 | 0 | 1.109 |
| Segments | 13,513,067 | 1,881 | 1 | 4,230 | 8 | 3,113 | 2,727 | 0.000 |
| Sum (gpm) | 4,504,356 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 67,565,334 | - | - | - | - | - | - | 2.026 |
| Minutes (5x) | | 9,405 | 5 | 21,150 | 40 | 15,565 | 13,635 | |
| Hours | | 157 | 0 | 353 | 1 | 259 | 227 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - JULY 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 21:49:26 | 2307.12 | 0 | 0 | 1 | 0 | 0 | 0 | 4.616 |
| 21:54:26 | 2307.12 | 0 | 0 | 1 | 0 | 0 | 0 | 4.616 |
| 21:59:26 | 2307.12 | 0 | 0 | 1 | 0 | 0 | 0 | 5 |
| 22:04:26 | 2449.59 | 1 | 0 | 1 | 0 | 0 | 0 | 4.572 |
| 22:09:26 | 2449.59 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| 22:14:26 | 2449.59 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| 22:19:26 | 1071.74 | 1 | 0 | 1 | 0 | 0 | 0 | 3.318 |
| 22:24:26 | 1071.74 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| 22:29:26 | 1071.74 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| 22:34:26 | 2549.65 | 0 | 0 | 1 | 0 | 0 | 0 | 5 |
| 22:39:26 | 2549.65 | 0 | 0 | 1 | 0 | 0 | 0 | 4.996 |
| 22:44:26 | 2549.65 | 0 | 0 | 1 | 0 | 0 | 0 | 5 |
| 22:49:26 | 2045.06 | 0 | 0 | 1 | 0 | 0 | 0 | 4.637 |
| 22:54:26 | 2045.06 | 0 | 0 | 1 | 0 | 0 | 0 | 4.637 |
| 22:59:26 | 2045.06 | 0 | 0 | 1 | 0 | 0 | 0 | 4.64 |
| 23:04:26 | 1691.1 | 0 | 0 | 1 | 0 | 0 | 0 | 3.71 |
| 23:09:26 | 1691.1 | 0 | 0 | 1 | 0 | 0 | 0 | 3.157 |
| 23:14:26 | 1691.1 | 0 | 0 | 1 | 0 | 0 | 0 | 3.032 |
| 23:19:26 | 2049.2 | 0 | 0 | 1 | 0 | 0 | 0 | 4.182 |
| 23:24:26 | 2049.2 | 0 | 0 | 1 | 0 | 0 | 0 | 4.784 |
| 23:29:26 | 2049.2 | 0 | 0 | 1 | 0 | 0 | 0 | 3.405 |
| 23:34:26 | 1573.22 | 0 | 0 | 1 | 0 | 0 | 0 | 4.276 |
| 23:39:26 | 1573.22 | 0 | 0 | 1 | 0 | 0 | 0 | 3.346 |
| 23:44:26 | 1573.22 | 0 | 0 | 1 | 0 | 0 | 0 | 5 |
| 23:49:26 | 1576.17 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| 23:54:26 | 1576.17 | 1 | 0 | 1 | 0 | 0 | 0 | 4.944 |
| 23:59:26 | 1576.17 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
| Segments | 13,211,369 | 1,890 | 3 | 4,205 | 4 | 3,077 | 2,680 | 0.000 |
| Sum (gpm) | 4,403,790 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 66,056,844 | - | - | - | - | - | - | 2.656 |
| Minutes (5x) | | 9,450 | 15 | 21,025 | 20 | 15,385 | 13,400 | |
| Hours | | 158 | 0 | 350 | 0 | 256 | 223 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - AUGUST 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 20:42:39 | 1207.22 | 0 | 0 | 0 | 0 | 0 | 1 | 3.943 |
| 20:47:39 | 1506.91 | 0 | 0 | 0 | 0 | 0 | 1 | 4.031 |
| 20:52:39 | 1506.91 | 0 | 0 | 0 | 0 | 1 | 0 | 4.029 |
| 20:57:39 | 1506.91 | 0 | 0 | 0 | 0 | 1 | 0 | 4.127 |
| 21:02:39 | 1418.67 | 0 | 0 | 0 | 0 | 1 | 0 | 4.193 |
| 21:07:39 | 1418.67 | 0 | 0 | 0 | 0 | 1 | 0 | 4.235 |
| 21:12:39 | 1418.67 | 0 | 0 | 0 | 0 | 1 | 0 | 4.291 |
| 21:17:39 | 1302.12 | 0 | 0 | 0 | 0 | 1 | 0 | 4.227 |
| 21:22:39 | 1302.12 | 0 | 0 | 0 | 0 | 0 | 1 | 4.295 |
| 21:27:39 | 1302.12 | 0 | 0 | 0 | 0 | 0 | 1 | 4.3 |
| 21:32:39 | 931.212 | 0 | 0 | 0 | 0 | 0 | 1 | 4.299 |
| 21:37:39 | 931.212 | 0 | 0 | 0 | 0 | 0 | 1 | 4.223 |
| 21:42:39 | 931.212 | 0 | 0 | 0 | 0 | 1 | 0 | 4.15 |
| 21:47:39 | 1636.44 | 0 | 0 | 0 | 0 | 1 | 0 | 4.178 |
| 21:52:39 | 1636.44 | 0 | 0 | 0 | 0 | 1 | 0 | 4.095 |
| 21:57:39 | 1636.44 | 0 | 0 | 0 | 0 | 1 | 0 | 4.072 |
| 22:02:39 | 1327.76 | 0 | 0 | 0 | 0 | 1 | 0 | 3.949 |
| 22:07:39 | 1327.76 | 0 | 0 | 0 | 0 | 0 | 1 | 3.946 |
| 22:12:39 | 1327.76 | 1 | 0 | 0 | 0 | 0 | 1 | 3.91 |
| 22:17:39 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1.8 |
| 22:22:39 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 3.071 |
| 22:27:39 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 3.102 |
| 22:32:39 | 453.063 | 1 | 0 | 1 | 0 | 1 | 0 | 3.147 |
| 22:37:39 | 453.063 | 1 | 0 | 1 | 0 | 1 | 0 | 3.294 |
| 22:42:38 | 453.063 | 1 | 0 | 1 | 0 | 1 | 0 | 3.289 |
| 22:47:38 | 1385.13 | 1 | 0 | 1 | 0 | 1 | 0 | 3.241 |
| 22:52:38 | 1385.13 | 1 | 0 | 1 | 0 | 1 | 0 | 3.303 |
| 22:57:38 | 1385.13 | 1 | 0 | 1 | 0 | 1 | 0 | 3.154 |
| 23:02:38 | 2756.3 | 0 | 0 | 1 | 0 | 1 | 0 | 3.154 |
| 23:07:38 | 2756.3 | 0 | 0 | 1 | 0 | 1 | 0 | 3.103 |
| 23:12:38 | 2756.3 | 0 | 0 | 0 | 0 | 0 | 1 | 3.512 |
| 23:17:38 | 1211 | 0 | 0 | 0 | 0 | 0 | 1 | 3.467 |
| 23:22:38 | 1211 | 0 | 0 | 0 | 0 | 0 | 1 | 3.484 |
| 23:27:38 | 1211 | 0 | 0 | 0 | 0 | 0 | 1 | 3.535 |
| 23:32:38 | 916.198 | 0 | 0 | 0 | 0 | 0 | 1 | 3.535 |
| 23:37:38 | 916.198 | 0 | 0 | 0 | 0 | 0 | 0 | 3.503 |
| 23:42:38 | 916.198 | 0 | 0 | 0 | 0 | 0 | 1 | 3.527 |
| 23:47:38 | 1133.83 | 0 | 0 | 0 | 0 | 0 | 0 | 3.586 |
| 23:52:38 | 1133.83 | 0 | 0 | 0 | 0 | 0 | 1 | 3.574 |
| 23:57:38 | 1133.83 | 0 | 0 | 0 | 0 | 0 | 0 | 3.574 |
| Segments | 13,031,412 | 1,923 | 0 | 4,509 | 55 | 3,140 | 2,901 | 0.000 |
| Sum (gpm) | 4,343,804 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 65,157,060 | - | - | - | - | - | - | 2.899 |
| Minutes (5x) | | 9,615 | 0 | 22,545 | 275 | 15,700 | 14,505 | |
| Hours | | 160 | 0 | 376 | 5 | 262 | 242 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - SEPTEMBER 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 21:22:02 | 787.2 | 0 | 0 | 0 | 0 | 1 | 0 | 2.671 |
| 21:27:02 | 787.2 | 0 | 0 | 0 | 0 | 1 | 0 | 2.641 |
| 21:32:02 | 886.45 | 0 | 0 | 0 | 0 | 1 | 0 | 2.575 |
| 21:37:02 | 886.45 | 0 | 0 | 0 | 0 | 1 | 0 | 2.57 |
| 21:42:02 | 886.45 | 0 | 0 | 0 | 0 | 1 | 0 | 2.539 |
| 21:47:02 | 681.857 | 0 | 0 | 0 | 0 | 1 | 0 | 2.496 |
| 21:52:02 | 681.857 | 0 | 0 | 0 | 0 | 1 | 0 | 2.501 |
| 21:57:02 | 681.857 | 0 | 0 | 0 | 0 | 1 | 0 | 2.501 |
| 22:02:02 | 1036.69 | 0 | 0 | 0 | 0 | 1 | 0 | 2.422 |
| 22:07:02 | 1036.69 | 0 | 0 | 0 | 0 | 1 | 0 | 2.441 |
| 22:12:02 | 1036.69 | 0 | 0 | 0 | 0 | 1 | 0 | 2.397 |
| 22:17:02 | 640.457 | 0 | 0 | 0 | 0 | 1 | 0 | 2.383 |
| 22:22:02 | 640.457 | 0 | 0 | 0 | 0 | 0 | 1 | 2.363 |
| 22:27:02 | 640.457 | 0 | 0 | 0 | 0 | 0 | 1 | 2.342 |
| 22:32:02 | 933.843 | 0 | 0 | 0 | 0 | 1 | 0 | 2.293 |
| 22:37:02 | 933.843 | 0 | 0 | 0 | 0 | 1 | 0 | 2.266 |
| 22:42:02 | 933.843 | 0 | 0 | 0 | 0 | 0 | 0 | 2.244 |
| 22:47:02 | 850.167 | 0 | 0 | 0 | 0 | 0 | 0 | 2.198 |
| 22:52:02 | 850.167 | 0 | 0 | 0 | 0 | 0 | 0 | 2.211 |
| 22:57:02 | 850.167 | 0 | 0 | 0 | 0 | 0 | 0 | 2.167 |
| 23:02:02 | 727.169 | 0 | 0 | 0 | 0 | 0 | 0 | 2.167 |
| 23:07:02 | 727.169 | 0 | 0 | 0 | 0 | 0 | 0 | 2.128 |
| 23:12:02 | 727.169 | 1 | 0 | 1 | 0 | 0 | 0 | 2.096 |
| 23:17:02 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.901 |
| 23:22:02 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.898 |
| 23:27:02 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.905 |
| 23:32:02 | 633.082 | 1 | 0 | 1 | 0 | 0 | 0 | 1.941 |
| 23:37:02 | 633.082 | 1 | 0 | 1 | 0 | 0 | 0 | 1.945 |
| 23:42:02 | 633.082 | 1 | 0 | 1 | 0 | 0 | 0 | 1.95 |
| 23:47:02 | 553.731 | 1 | 0 | 1 | 0 | 0 | 0 | 1.929 |
| 23:52:02 | 553.731 | 0 | 0 | 1 | 0 | 0 | 0 | 1.988 |
| 23:57:02 | 553.731 | 0 | 0 | 1 | 0 | 0 | 0 | 1.998 |
| Segments | 10,956,739 | 1,457 | 0 | 4,282 | 0 | 3,379 | 2,975 | 0.000 |
| Sum (gpm) | 3,652,246 | - | - | - | - | - | - | 4.823 |
| (gal) (15x) | 54,783,694 | - | - | - | - | - | - | 2.662 |
| Minutes (5x) | | 7,285 | 0 | 21,410 | 0 | 16,895 | 14,875 | |
| Hours | | 121 | 0 | 357 | 0 | 282 | 248 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - OCTOBER 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 22:58:08 | 783.066 | 0 | 0 | 0 | 0 | 1 | 0 | 3.667 |
| 23:03:08 | 619.077 | 0 | 0 | 0 | 0 | 1 | 0 | 3.714 |
| 23:08:08 | 619.077 | 0 | 0 | 0 | 0 | 1 | 0 | 3.684 |
| 23:13:08 | 619.077 | 0 | 0 | 0 | 0 | 0 | 1 | 3.62 |
| 23:18:08 | 635.506 | 0 | 0 | 0 | 0 | 0 | 1 | 3.643 |
| 23:23:08 | 635.506 | 0 | 0 | 0 | 0 | 0 | 1 | 3.609 |
| 23:28:06 | 635.506 | 0 | 0 | 0 | 0 | 0 | 1 | 3.643 |
| 23:33:06 | 530.363 | 0 | 0 | 0 | 0 | 1 | 0 | 3.636 |
| 23:38:06 | 530.363 | 0 | 0 | 0 | 0 | 1 | 0 | 3.582 |
| 23:43:06 | 530.363 | 0 | 0 | 0 | 0 | 1 | 0 | 3.553 |
| 23:48:06 | 657.711 | 0 | 0 | 0 | 0 | 1 | 0 | 3.566 |
| 23:53:06 | 657.711 | 0 | 0 | 0 | 0 | 1 | 0 | 3.543 |
| 23:58:06 | 657.711 | 0 | 0 | 0 | 0 | 1 | 0 | 3.554 |
| Segments | 9,608,770 | 1,022 | 0 | 3,631 | 10 | 3,679 | 3,250 | 0.000 |
| Sum (gpm) | 3,202,923 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 48,043,852 | - | - | - | - | - | - | 2.979 |
| Minutes (5x) | | 5,110 | 0 | 18,155 | 50 | 18,395 | 16,250 | |
| Hours | | 85 | 0 | 303 | 1 | 307 | 271 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - NOVEMBER 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 9:13:23 | 1610.54 | 0 | 0 | 1 | 0 | 0 | 0 | 2.274 |
| 9:18:23 | 1671.35 | 0 | 0 | 1 | 0 | 0 | 1 | 3.527 |
| 9:23:23 | 1671.35 | 0 | 0 | 1 | 0 | 0 | 1 | 3.596 |
| 9:28:23 | 1671.35 | 0 | 0 | 1 | 0 | 0 | 1 | 3.622 |
| 9:33:23 | 1367.72 | 0 | 0 | 1 | 0 | 0 | 1 | 3.632 |
| 9:38:23 | 1367.72 | 0 | 0 | 1 | 0 | 0 | 1 | 3.588 |
| 9:43:23 | 1367.72 | 0 | 0 | 1 | 0 | 0 | 1 | 3.563 |
| 9:48:23 | 1902.11 | 1 | 0 | 1 | 0 | 0 | 1 | 3.574 |
| Segments | 6,654,166 | 786 | 1 | 2,443 | 0 | 2,750 | 2,400 | 1.720 |
| Sum (gpm) | 2,218,055 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 33,270,831 | - | - | - | - | - | - | 3.571 |
| Minutes (5x) | | 3,930 | 5 | 12,215 | 0 | 13,750 | 12,000 | |
| Hours | | 66 | 0 | 204 | 0 | 229 | 200 | |

Min.
Max.
Avg.

*Note: Data is available from datalog from November 1 to November 23

Assume data is extrapolated to 31 days:

| | | | | | | |
|------------|--------|--------|--------|--------|--------|--------|
| 44,843,294 | 5,297 | 7 | 16,464 | 0 | 18,533 | 16,174 |
| (gal) | (min.) | (min.) | (min.) | (min.) | (min.) | (min.) |

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - DECEMBER 1994

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 23:24:17 | 1545.83 | 0 | 0 | 1 | 0 | 0 | 0 | 1.639 |
| 23:29:17 | 1545.83 | 0 | 0 | 1 | 0 | 0 | 0 | 1.629 |
| 23:34:17 | 1253.4 | 0 | 0 | 1 | 0 | 0 | 0 | 1.619 |
| 23:39:17 | 1253.4 | 0 | 0 | 1 | 0 | 0 | 0 | 1.6 |
| 23:44:17 | 1253.4 | 0 | 0 | 1 | 0 | 0 | 0 | 1.61 |
| 23:49:17 | 962.337 | 0 | 0 | 1 | 0 | 0 | 0 | 1.61 |
| 23:54:17 | 962.337 | 0 | 0 | 1 | 0 | 0 | 0 | 1.635 |
| 23:59:17 | 962.337 | 0 | 0 | 1 | 0 | 0 | 0 | 1.641 |
| Segments | 11,540,595 | 1,205 | 0 | 4,240 | 25 | 3,170 | 2,874 | 0.000 |
| Sum (gpm) | 3,846,865 | - | - | - | - | - | - | 5 |
| (gal) (15x) | 57,702,973 | - | - | - | - | - | - | 2.535 |
| Minutes (5x) | | 6,025 | 0 | 21,200 | 125 | 15,850 | 14,370 | |
| Hours | | 100 | 0 | 353 | 2 | 264 | 240 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - JANUARY 1995

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 22:15:33 | 928.617 | 1 | 0 | 1 | 0 | 0 | 0 | 1.685 |
| 22:20:33 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.551 |
| 22:25:33 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.575 |
| 22:30:33 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.56 |
| 22:35:33 | 689.344 | 1 | 0 | 1 | 0 | 0 | 0 | 1.56 |
| 22:40:33 | 689.344 | 1 | 0 | 1 | 0 | 0 | 0 | 1.588 |
| 22:45:33 | 689.344 | 1 | 0 | 1 | 0 | 0 | 0 | 1.625 |
| 22:50:33 | 3556.65 | 0 | 0 | 1 | 0 | 0 | 0 | 1.59 |
| 22:55:33 | 3556.65 | 0 | 0 | 1 | 0 | 0 | 0 | 1.6 |
| 23:00:33 | 3556.65 | 0 | 0 | 1 | 0 | 0 | 0 | 1.61 |
| 23:05:33 | 1725.64 | 0 | 0 | 1 | 0 | 0 | 0 | 1.599 |
| 23:10:33 | 1725.64 | 0 | 0 | 1 | 0 | 0 | 0 | 1.586 |
| 23:15:33 | 1725.64 | 0 | 0 | 1 | 0 | 0 | 0 | 1.568 |
| 23:20:33 | 1354.01 | 0 | 0 | 1 | 0 | 0 | 0 | 1.613 |
| 23:25:33 | 1354.01 | 0 | 0 | 1 | 0 | 0 | 0 | 1.619 |
| 23:30:33 | 1354.01 | 0 | 0 | 1 | 0 | 0 | 0 | 1.595 |
| 23:35:33 | 1371.98 | 0 | 0 | 1 | 0 | 0 | 0 | 1.584 |
| 23:40:33 | 1371.98 | 0 | 0 | 1 | 0 | 0 | 0 | 1.584 |
| 23:45:33 | 1371.98 | 0 | 0 | 0 | 0 | 0 | 0 | 1.638 |
| 23:50:33 | 1060.88 | 0 | 0 | 0 | 0 | 0 | 0 | 1.688 |
| 23:55:33 | 1060.88 | 0 | 0 | 0 | 0 | 0 | 0 | 1.721 |
| Segments | 12,822,247 | 1,413 | 0 | 4,272 | 22 | 0 | 60 | 0.706 |
| Sum (gpm) | 4,274,082 | - | - | - | - | - | - | 2.045 |
| (gal) (15x) | 64,111,233 | - | - | - | - | - | - | 1.498 |
| Minutes (5x) | | 7,065 | 0 | 21,360 | 110 | 0 | 300 | |
| Hours | | 118 | 0 | 356 | 2 | 0 | 5 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - FEBRUARY 1995

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 20:52:56 | 1793 | 0 | 0 | 1 | 0 | 1 | 0 | 1.22 |
| 20:57:56 | 1793 | 0 | 0 | 1 | 0 | 1 | 0 | 1.195 |
| 21:02:56 | 949.42 | 0 | 0 | 1 | 0 | 1 | 0 | 1.183 |
| 21:07:56 | 949.42 | 0 | 0 | 1 | 0 | 1 | 0 | 1.203 |
| 21:12:56 | 949.42 | 0 | 0 | 1 | 0 | 1 | 0 | 1.188 |
| 21:17:56 | 2006.82 | 0 | 0 | 1 | 0 | 1 | 0 | 1.173 |
| 21:22:56 | 2006.82 | 0 | 0 | 1 | 0 | 1 | 0 | 1.187 |
| 21:27:56 | 2006.82 | 0 | 0 | 0 | 0 | 0 | 1 | 1.211 |
| 21:32:56 | 1470.82 | 0 | 0 | 0 | 0 | 0 | 1 | 1.163 |
| 21:37:56 | 1470.82 | 0 | 0 | 0 | 0 | 0 | 1 | 1.198 |
| 21:42:56 | 1470.82 | 0 | 0 | 0 | 0 | 0 | 1 | 1.172 |
| 21:47:55 | 1202.08 | 0 | 0 | 0 | 0 | 0 | 1 | 1.176 |
| 21:52:55 | 1202.08 | 0 | 0 | 0 | 0 | 0 | 1 | 1.183 |
| 21:57:55 | 1202.08 | 0 | 0 | 0 | 0 | 0 | 1 | 1.182 |
| 22:02:55 | 746.063 | 0 | 0 | 0 | 0 | 0 | 1 | 1.171 |
| 22:07:55 | 746.063 | 0 | 0 | 0 | 0 | 0 | 1 | 1.171 |
| 22:12:55 | 746.063 | 0 | 0 | 0 | 0 | 0 | 1 | 1.2 |
| 22:17:55 | 1608.95 | 0 | 0 | 0 | 0 | 0 | 1 | 1.145 |
| 22:22:55 | 1608.95 | 0 | 0 | 0 | 0 | 0 | 1 | 1.157 |
| 22:27:55 | 1608.95 | 0 | 0 | 0 | 0 | 0 | 1 | 1.157 |
| 22:32:55 | 971.397 | 0 | 0 | 0 | 0 | 0 | 1 | 1.176 |
| 22:37:55 | 971.397 | 0 | 0 | 0 | 0 | 0 | 1 | 1.161 |
| 22:42:55 | 971.397 | 0 | 0 | 0 | 0 | 0 | 1 | 1.163 |
| 22:47:55 | 1240.32 | 0 | 0 | 0 | 0 | 0 | 1 | 1.163 |
| 22:52:55 | 1240.32 | 0 | 0 | 0 | 0 | 0 | 0 | 1.206 |
| 22:57:55 | 1240.32 | 0 | 0 | 0 | 0 | 0 | 0 | 1.145 |
| 23:02:55 | 793.373 | 0 | 0 | 0 | 0 | 0 | 0 | 1.152 |
| 23:07:55 | 793.373 | 0 | 0 | 0 | 0 | 0 | 0 | 1.161 |
| 23:12:55 | 793.373 | 0 | 0 | 0 | 0 | 0 | 0 | 1.202 |
| 23:17:55 | 1201.54 | 0 | 0 | 0 | 0 | 0 | 0 | 1.147 |
| 23:22:55 | 1201.54 | 0 | 0 | 0 | 0 | 0 | 0 | 1.16 |
| 23:27:55 | 1201.54 | 0 | 0 | 0 | 0 | 0 | 0 | 1.179 |
| 23:32:55 | 616.804 | 1 | 0 | 1 | 0 | 1 | 0 | 1.121 |
| 23:37:55 | 616.804 | 1 | 0 | 1 | 0 | 1 | 0 | 1.113 |
| 23:42:55 | 616.804 | 1 | 0 | 1 | 0 | 1 | 0 | 1.101 |
| 23:47:55 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1.148 |
| 23:52:55 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1.157 |
| 23:57:55 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1.137 |
| Segments | 11,025,928 | 1,252 | 32 | 3,739 | 0 | 1,675 | 2,590 | 0.000 |
| Sum (gpm) | 3,675,309 | - | - | - | - | - | - | 2.426 |
| (gal) (15x) | 55,129,641 | - | - | - | - | - | - | 1.388 |
| Minutes (5x) | | 6,260 | 160 | 18,695 | 0 | 8,375 | 12,950 | |
| Hours | | 104 | 3 | 312 | 0 | 140 | 216 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - MARCH 1995

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 21:28:48 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.723 |
| 21:33:48 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.724 |
| 21:38:48 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1.762 |
| 21:43:48 | 171.039 | 1 | 0 | 1 | 0 | 1 | 0 | 1.762 |
| 21:48:48 | 171.039 | 1 | 0 | 1 | 0 | 1 | 0 | 1.756 |
| 21:53:48 | 171.039 | 1 | 0 | 1 | 0 | 1 | 0 | 1.756 |
| 21:58:48 | 3043.09 | 0 | 0 | 1 | 0 | 1 | 0 | 1.756 |
| 22:03:48 | 3043.09 | 0 | 0 | 1 | 0 | 1 | 0 | 1.739 |
| 22:08:48 | 3043.09 | 0 | 0 | 1 | 0 | 1 | 0 | 1.774 |
| 22:13:48 | 2450.98 | 0 | 0 | 1 | 0 | 0 | 0 | 1.733 |
| 22:18:48 | 2450.98 | 0 | 0 | 1 | 0 | 0 | 0 | 1.706 |
| 22:23:48 | 2450.98 | 0 | 0 | 1 | 0 | 0 | 0 | 1.678 |
| 22:28:48 | 1742.47 | 0 | 0 | 1 | 0 | 0 | 0 | 1.68 |
| 22:33:48 | 1742.47 | 0 | 0 | 1 | 0 | 0 | 0 | 1.698 |
| 22:38:48 | 1742.47 | 0 | 0 | 1 | 0 | 0 | 0 | 1.655 |
| 22:43:48 | 1139.96 | 0 | 0 | 1 | 0 | 0 | 0 | 1.637 |
| 22:48:48 | 1139.96 | 0 | 0 | 1 | 0 | 0 | 1 | 1.645 |
| 22:53:48 | 1139.96 | 0 | 0 | 1 | 0 | 0 | 1 | 1.654 |
| 22:58:48 | 1117.89 | 0 | 0 | 1 | 0 | 0 | 1 | 1.617 |
| 23:03:48 | 1117.89 | 0 | 0 | 1 | 0 | 0 | 1 | 1.643 |
| 23:08:48 | 1117.89 | 0 | 0 | 1 | 0 | 0 | 1 | 1.643 |
| 23:13:48 | 1406.78 | 0 | 0 | 1 | 0 | 0 | 1 | 1.631 |
| 23:18:48 | 1406.78 | 0 | 0 | 0 | 0 | 0 | 1 | 1.602 |
| 23:23:48 | 1406.78 | 0 | 0 | 0 | 0 | 0 | 1 | 1.595 |
| 23:28:48 | 897.878 | 0 | 0 | 0 | 0 | 0 | 1 | 1.583 |
| 23:33:48 | 897.878 | 0 | 0 | 0 | 0 | 0 | 1 | 1.595 |
| 23:38:48 | 897.878 | 0 | 0 | 0 | 0 | 0 | 1 | 1.608 |
| 23:43:48 | 891.219 | 0 | 0 | 0 | 0 | 0 | 1 | 1.643 |
| 23:48:48 | 891.219 | 0 | 0 | 0 | 0 | 0 | 1 | 1.618 |
| 23:53:48 | 891.219 | 0 | 0 | 0 | 0 | 0 | 1 | 1.611 |
| 23:58:48 | 781.453 | 0 | 0 | 0 | 0 | 0 | 1 | 1.611 |
| Segments | 11,977,602 | 1,447 | 0 | 4,225 | 4 | 1,719 | 2,819 | 1.081 |
| Sum (gpm) | 3,992,534 | - | - | - | - | - | - | 2.137 |
| (gal) (15x) | 59,888,010 | - | - | - | - | - | - | 1.485 |
| Minutes (5x) | | 7,235 | 0 | 21,125 | 20 | 8,595 | 14,095 | |
| Hours | | 121 | 0 | 352 | 0 | 143 | 235 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - MAY 1995

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 22:14:08 | 1480.57 | 0 | 0 | 0 | 0 | 1 | 0 | 2.014 |
| 22:19:08 | 1480.57 | 0 | 0 | 0 | 0 | 1 | 0 | 2.023 |
| 22:24:08 | 1480.57 | 0 | 0 | 0 | 0 | 1 | 0 | 2.006 |
| 22:29:08 | 1599.02 | 0 | 0 | 0 | 0 | 1 | 0 | 2.019 |
| 22:34:08 | 1599.02 | 0 | 0 | 0 | 0 | 1 | 0 | 1.99 |
| 22:39:06 | 1599.02 | 0 | 0 | 0 | 0 | 1 | 0 | 1.982 |
| 22:44:06 | 1266.92 | 0 | 0 | 0 | 0 | 1 | 0 | 2.015 |
| 22:49:06 | 1266.92 | 0 | 0 | 0 | 0 | 1 | 0 | 1.998 |
| 22:54:06 | 1266.92 | 0 | 0 | 0 | 0 | 1 | 0 | 1.998 |
| 22:59:06 | 1357.74 | 0 | 0 | 0 | 0 | 1 | 0 | 2.048 |
| 23:04:06 | 1357.74 | 0 | 0 | 0 | 0 | 0 | 0 | 1.997 |
| 23:09:06 | 1357.74 | 0 | 0 | 0 | 0 | 0 | 0 | 2.015 |
| 23:14:06 | 1195.79 | 0 | 0 | 0 | 0 | 0 | 0 | 1.975 |
| 23:19:06 | 1195.79 | 0 | 0 | 0 | 0 | 0 | 0 | 1.952 |
| 23:24:06 | 1195.79 | 0 | 0 | 0 | 0 | 0 | 0 | 2.015 |
| 23:29:06 | 814.897 | 0 | 0 | 0 | 0 | 0 | 0 | 2.01 |
| 23:34:06 | 814.897 | 0 | 0 | 0 | 0 | 0 | 0 | 1.974 |
| 23:39:06 | 814.897 | 0 | 0 | 0 | 0 | 0 | 0 | 1.959 |
| 23:44:06 | 1061.77 | 0 | 0 | 0 | 0 | 0 | 0 | 1.987 |
| 23:49:06 | 1061.77 | 0 | 0 | 0 | 0 | 0 | 0 | 1.987 |
| 23:54:06 | 1061.77 | 0 | 0 | 0 | 0 | 0 | 0 | 1.982 |
| 23:59:06 | 978.875 | 0 | 0 | 0 | 0 | 0 | 0 | 1.986 |
| Segments | 13,505,787 | 1,638 | 0 | 4,166 | 20 | 1,994 | 3,189 | 0.000 |
| Sum (gpm) | 4,501,929 | - | - | - | - | - | - | 2.295 |
| (gal) (15x) | 67,528,936 | - | - | - | - | - | - | 1.391 |
| Minutes (5x) | | 8,190 | 0 | 20,830 | 100 | 9,970 | 15,945 | |
| Hours | | 137 | 0 | 347 | 2 | 166 | 266 | |

*Note: Data for 5/1/95 from 00:00 to 08:00 was not available from database. Data from 5/1/94 (00:00 to 08:00) was substituted.

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - JUNE 1995

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 21:44:21 | 2319.35 | 0 | 0 | 1 | 0 | 1 | 0 | 2.031 |
| 21:49:21 | 2148.21 | 0 | 0 | 1 | 0 | 0 | 0 | 2.061 |
| 21:54:21 | 2148.21 | 0 | 0 | 1 | 0 | 0 | 1 | 2.061 |
| 21:59:21 | 2148.21 | 0 | 0 | 1 | 0 | 0 | 1 | 2.061 |
| 22:04:21 | 283.098 | 0 | 0 | 1 | 0 | 0 | 1 | 2.092 |
| 22:09:21 | 283.098 | 0 | 0 | 1 | 0 | 0 | 1 | 2.069 |
| 22:14:21 | 283.098 | 1 | 0 | 1 | 0 | 0 | 1 | 2.052 |
| 22:19:21 | 2725.51 | 1 | 0 | 1 | 0 | 0 | 1 | 2.103 |
| 22:24:21 | 2725.51 | 1 | 0 | 1 | 0 | 0 | 0 | 2.093 |
| 22:29:21 | 2725.51 | 1 | 0 | 1 | 0 | 0 | 0 | 2.031 |
| 22:34:21 | 1473.81 | 1 | 0 | 1 | 0 | 0 | 0 | 2.065 |
| 22:39:21 | 1473.81 | 1 | 0 | 1 | 0 | 0 | 0 | 2.061 |
| 22:44:21 | 1473.81 | 0 | 0 | 1 | 0 | 0 | 0 | 2.073 |
| 22:49:21 | 2587.17 | 0 | 0 | 1 | 0 | 0 | 0 | 2.081 |
| 22:54:21 | 2587.17 | 0 | 0 | 1 | 0 | 0 | 0 | 2.062 |
| 22:59:21 | 2587.17 | 0 | 0 | 1 | 0 | 0 | 0 | 2.062 |
| 23:04:21 | 415.895 | 0 | 0 | 1 | 0 | 0 | 1 | 2.062 |
| 23:09:21 | 415.895 | 0 | 0 | 1 | 0 | 0 | 1 | 2.097 |
| 23:14:21 | 415.895 | 0 | 0 | 1 | 0 | 0 | 1 | 2.086 |
| 23:19:21 | 3125 | 0 | 0 | 1 | 0 | 0 | 1 | 2.078 |
| 23:24:21 | 3125 | 0 | 0 | 1 | 0 | 0 | 1 | 2.08 |
| 23:29:21 | 3125 | 0 | 0 | 1 | 0 | 0 | 1 | 2.069 |
| 23:34:21 | 1234.28 | 0 | 0 | 1 | 0 | 0 | 1 | 2.109 |
| 23:39:21 | 1234.28 | 0 | 0 | 1 | 0 | 0 | 1 | 2.112 |
| 23:44:21 | 1234.28 | 0 | 0 | 1 | 0 | 0 | 1 | 2.088 |
| 23:49:21 | 2779.98 | 0 | 0 | 1 | 0 | 0 | 1 | 2.099 |
| 23:54:21 | 2779.98 | 0 | 0 | 1 | 0 | 0 | 1 | 2.076 |
| 23:59:21 | 2779.98 | 0 | 0 | 1 | 0 | 0 | 1 | 2.064 |
| Segments | 16,731,572 | 2,715 | 0 | 4,378 | 1,935 | 1,640 | 2,260 | 1.010 |
| Sum (gpm) | 5,577,191 | - | - | - | - | - | - | 2.734 |
| (gal) (15x) | 83,657,862 | - | - | - | - | - | - | 1.644 |
| Minutes (5x) | | 13,575 | 0 | 21,890 | 9,675 | 8,200 | 11,300 | |
| Hours | | 226 | 0 | 365 | 161 | 137 | 188 | |

Min.
Max.
Avg.

Water Conservation Study
Ft. Drum, NY

TELEMETERING SYSTEM DATALOG #1 - JULY 1995

| Time/ Date | Avg. Flow On Post (gpm) | Vault 3 Valve 1 (Tank 3) | Vault 3 Valve 2 (Tank 3) | DANC First Pump Operation | DANC 2nd Pump Operation | Reservoir Draining | Reservoir Filling | DANC Chlorine Residual |
|---------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|-------------------------------|-----------------------|----------------------|------------------------------|
| 23:26:21 | 1020.64 | 1 | 0 | 0 | 0 | 1 | 0 | 1.943 |
| 23:31:21 | 1228.52 | 1 | 0 | 0 | 0 | 1 | 0 | 2.054 |
| 23:36:21 | 1228.52 | 1 | 0 | 0 | 0 | 1 | 0 | 2.062 |
| 23:41:21 | 1228.52 | 1 | 0 | 0 | 0 | 1 | 0 | 2.086 |
| 23:46:21 | 1198.4 | 1 | 0 | 1 | 0 | 1 | 0 | 1.337 |
| 23:51:21 | 1198.4 | 1 | 0 | 1 | 0 | 1 | 0 | 1.907 |
| 23:56:21 | 1198.4 | 1 | 0 | 1 | 0 | 0 | 0 | 1.954 |
| Segments | 16,107,849 | 3,288 | 627 | 3,828 | 186 | 1,538 | 959 | 0.874 |
| Sum (gpm) | 5,369,283 | - | - | - | - | - | - | 3.277 |
| (gal) (15x) | 80,539,244 | - | - | - | - | - | - | 1.562 |
| Minutes (5x) | | 16,440 | 3,135 | 19,140 | 930 | 7,690 | 4,795 | |
| Hours | | 274 | 52 | 319 | 16 | 128 | 80 | |

Min.
Max.
Avg.

SUMMARY - DATALOG #2: WELL OPERATING TIMES (MINUTES)

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total |
|---------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-----------|
| Aug-93 | 9,660 | 26,170 | 9,930 | 9,795 | 1,905 | 6,775 | 9,680 | 6,560 | 22,200 | 9,310 | 3,295 | 115,280 |
| Sep-93 | 6,365 | 7,350 | 5,225 | 6,510 | 12,830 | 12,605 | 12,665 | 4,480 | 13,210 | 6,200 | 11,225 | 98,665 |
| Oct-93 | 4,538 | 24,705 | 3,918 | 3,884 | 14,510 | 4,228 | 4,555 | 10,695 | 5,296 | 2,695 | 2,566 | 81,590 |
| Nov-93 | 2,715 | 16,655 | 9,240 | 2,555 | 14,365 | 0 | 10,460 | 5,460 | 5,790 | 100 | 3,080 | 70,420 |
| Dec-93 | 4,141 | 11,476 | 8,802 | 4,041 | 8,293 | 0 | 8,569 | 10,075 | 5,264 | 0 | 7,246 | 67,907 |
| Jan-94 | 5,255 | 5,020 | 10,135 | 4,800 | 16,015 | 0 | 15,910 | 13,690 | 2,160 | 3,030 | 9,675 | 85,690 |
| Feb-94 | 2,255 | 16,365 | 3,620 | 2,495 | 9,185 | 0 | 9,435 | 7,775 | 15,205 | 4,780 | 3,080 | 74,195 |
| Mar-94 | 12,495 | 8,505 | 7,065 | 7,520 | 10,420 | 20 | 12,110 | 9,250 | 5,550 | 7,590 | 13,835 | 94,360 |
| Apr-94 | 1,230 | 16,885 | 15,495 | 1,570 | 6,840 | 0 | 6,775 | 5,920 | 4,110 | 1,435 | 2,435 | 62,695 |
| May-94 | 3,570 | 3,555 | 3,595 | 3,515 | 11,265 | 8,135 | 7,910 | 11,240 | 6,400 | 3,580 | 2,570 | 65,335 |
| Jun-94 | 9,320 | 9,525 | 9,470 | 9,280 | 13,090 | 10,225 | 9,655 | 4,940 | 12,035 | 9,250 | 9,480 | 106,270 |
| Jul-94 | 10,685 | 10,590 | 12,685 | 10,525 | 10,480 | 12,480 | 10,745 | 9,475 | 8,225 | 10,485 | 2,810 | 109,185 |
| Total (Min.) | 72,229 | 156,801 | 99,180 | 66,490 | 129,198 | 54,468 | 118,469 | 99,560 | 105,445 | 58,455 | 71,297 | 1,031,592 |
| Total (Hours) | 1,204 | 2,613 | 1,653 | 1,108 | 2,153 | 908 | 1,974 | 1,659 | 1,757 | 974 | 1,188 | 17,193 |
| Aug-94 | 7,075 | 7,125 | 7,005 | 6,995 | 7,165 | 10,055 | 9,490 | 7,770 | 5,375 | 8,420 | 7,240 | 83,715 |
| Sep-94 | 4,310 | 4,275 | 4,320 | 4,305 | 6,875 | 4,120 | 19,665 | 5,925 | 18,515 | 0 | 7,690 | 80,000 |
| Oct-94 | 865 | 6,010 | 7,640 | 885 | 8,585 | 4,885 | 13,550 | 825 | 7,615 | 855 | 3,000 | 54,715 |
| Nov-94 | 265 | 6,675 | 4,790 | 570 | 7,890 | 1,555 | 6,855 | 5,135 | 5,695 | 275 | 2,465 | 42,170 |
| Dec-94 | 1,315 | 5,175 | 950 | 1,315 | 7,365 | 8,535 | 12,930 | 7,060 | 8,530 | 1,305 | 1,765 | 56,245 |
| Jan-95 | 5,750 | 6,570 | 6,615 | 5,835 | 6,610 | 11,685 | 15,425 | 4,750 | 8,465 | 5,815 | 1,035 | 78,555 |
| Feb-95 | 2,970 | 5,590 | 6,380 | 2,970 | 3,530 | 9,540 | 7,005 | 6,520 | 5,135 | 2,920 | 8,090 | 60,650 |
| Mar-95 | 2,005 | 7,785 | 9,420 | 1,970 | 6,145 | 7,505 | 7,255 | 2,005 | 5,935 | 1,985 | 7,600 | 59,610 |
| Apr-95 | 1,075 | 7,350 | 6,365 | 1,070 | 7,285 | 8,160 | 7,260 | 570 | 1,155 | 1,095 | 7,960 | 49,345 |
| May-95 | 6,250 | 8,955 | 8,965 | 6,285 | 7,255 | 10,830 | 8,775 | 6,170 | 7,995 | 6,180 | 8,445 | 86,105 |
| Jun-95 | 9,925 | 9,038 | 15,500 | 10,188 | 19,250 | 9,175 | 13,550 | 0 | 11,025 | 10,088 | 10,013 | 117,752 |
| Jul-95 | 17,705 | 17,055 | 13,040 | 17,130 | 17,320 | 17,275 | 17,250 | 13,475 | 10,280 | 23,485 | 17,365 | 181,380 |
| Total (Min.) | 59,510 | 91,603 | 90,990 | 59,518 | 105,275 | 103,320 | 139,010 | 60,205 | 95,720 | 62,423 | 82,668 | 950,242 |
| Total (Hours) | 992 | 1,527 | 1,517 | 992 | 1,755 | 1,722 | 2,317 | 1,003 | 1,595 | 1,040 | 1,378 | 15,837 |
| Avg. (Min.) | 65,870 | 124,202 | 95,085 | 63,004 | 117,237 | 78,894 | 128,740 | 79,883 | 100,583 | 60,439 | 76,983 | 990,917 |
| Avg. (Hours) | 1,098 | 2,070 | 1,585 | 1,050 | 1,954 | 1,315 | 2,146 | 1,331 | 1,676 | 1,007 | 1,283 | 16,515 |

Annual operating hours as recorded by telemetry system. Operation of each well was checked by system every five minutes.

*Note: Telemetry data was incomplete, data was missing from October 12 to October 25. Values were extrapolated to estimate usage for 31 days.

**Note: Telemetry data was incomplete, data was given from December 1 to December 28. Values were extrapolated to estimate usage for 31 days.

***Note: Telemetry data was incomplete, data was given from June 1 to June 12. Values were extrapolated to estimate usage for 30 days.

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - AUGUST 1993

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 23:38:41 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:43:41 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:48:41 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:53:41 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:58:41 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Segments | 1,932 | 5,234 | 1,986 | 1,959 | 381 | 1,355 | 1,936 | 1,312 | 4,440 | 1,862 | 659 |
| Minutes (5X) | 9,660 | 26,170 | 9,930 | 9,795 | 1,905 | 6,775 | 9,680 | 6,560 | 22,200 | 9,310 | 3,295 |
| Hours | 161.00 | 436.17 | 165.50 | 163.25 | 31.75 | 112.92 | 161.33 | 109.33 | 370.00 | 155.17 | 54.92 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - SEPTEMBER 1993

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 23:23:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:28:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:33:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:38:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:43:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:48:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:53:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:58:33 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| Segments | 1,253 | 1,470 | 1,045 | 1,302 | 2,566 | 2,521 | 2,533 | 896 | 2,642 | 1,240 | 2,245 |
| Minutes (5X) | 6,265 | 7,350 | 5,225 | 6,510 | 12,830 | 12,605 | 12,665 | 4,480 | 13,210 | 6,200 | 11,225 |
| Hours | 104.42 | 122.50 | 87.08 | 108.50 | 213.83 | 210.08 | 211.08 | 74.67 | 220.17 | 103.33 | 187.08 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - OCTOBER 1993

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 20:39:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:44:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:49:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:54:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:59:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:04:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:09:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:24:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:29:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:34:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:39:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:44:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:49:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:54:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:59:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:04:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:09:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:24:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:29:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:34:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:39:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:44:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:49:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:54:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:59:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:04:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:09:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:24:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:29:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:34:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:39:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:44:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:49:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:54:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:59:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Segments | 527 | 2,869 | 455 | 451 | 1,685 | 491 | 529 | 1,242 | 615 | 313 | 298 |
| Minutes (5X) | 2,635 | 14,345 | 2,275 | 2,255 | 8,425 | 2,455 | 2,645 | 6,210 | 3,075 | 1,565 | 1,490 |
| Hours | 43.92 | 239.08 | 37.92 | 37.58 | 140.42 | 40.92 | 44.08 | 103.50 | 51.25 | 26.08 | 24.83 |

*Note: Telemetry data is incomplete. Data is missing from October 12 to October 25.

Assume data is extrapolated to 31 days:

| | | | | | | | | | | | |
|---------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|-------|
| Minutes | 4,538 | 24,705 | 3,918 | 3,884 | 14,510 | 4,228 | 4,555 | 10,695 | 5,296 | 2,695 | 2,566 |
| Hours | 75.63 | 411.75 | 65.30 | 64.73 | 241.83 | 70.47 | 75.92 | 178.25 | 88.26 | 44.92 | 42.77 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - NOVEMBER 1993

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 21:46:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 21:51:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 21:56:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:01:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:06:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:11:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:16:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:21:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:26:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:31:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:36:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:41:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:46:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:51:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 22:56:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:01:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:06:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:11:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:16:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:21:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:26:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:31:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:36:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:41:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:46:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:51:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:56:31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Segments | 543 | 3,331 | 1,848 | 511 | 2,873 | 0 | 2,092 | 1,092 | 1,158 | 20 | 616 |
| Minutes (5X) | 2,715 | 16,655 | 9,240 | 2,555 | 14,365 | 0 | 10,460 | 5,460 | 5,790 | 100 | 3,080 |
| Hours | 45.25 | 277.58 | 154.00 | 42.58 | 239.42 | 0.00 | 174.33 | 91.00 | 96.50 | 1.67 | 51.33 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - DECEMBER 1993

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 5:57:55 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:02:55 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:07:55 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:12:55 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:17:55 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:22:55 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:27:55 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Segments | 748 | 2,073 | 1,590 | 730 | 1,498 | 0 | 1,548 | 1,820 | 951 | 0 | 1,309 |
| Minutes (5X) | 3,740 | 10,365 | 7,950 | 3,650 | 7,490 | 0 | 7,740 | 9,100 | 4,755 | 0 | 6,545 |
| Hours | 62.33 | 172.75 | 132.50 | 60.83 | 124.83 | 0.00 | 129.00 | 151.67 | 79.25 | 0.00 | 109.08 |

*Note: Telemetry data is incomplete and only covers from December 1 to December 28 (06:28)

Assume data is extrapolated to 31 days:

| | | | | | | | | | | | |
|---------|-------|--------|--------|-------|--------|------|--------|--------|-------|------|--------|
| Minutes | 4,141 | 11,476 | 8,802 | 4,041 | 8,293 | 0 | 8,569 | 10,075 | 5,264 | 0 | 7,246 |
| Hours | 69.01 | 191.26 | 146.70 | 67.35 | 138.21 | 0.00 | 142.82 | 167.92 | 87.74 | 0.00 | 120.77 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - JANUARY 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 22:31:25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 22:36:25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 22:41:25 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 22:46:25 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 22:51:25 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 22:56:25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 23:01:25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 23:06:25 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 23:11:25 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 23:16:25 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 23:21:25 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 23:26:25 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 23:31:25 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 23:36:25 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 23:41:25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 23:46:25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 23:51:25 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 23:56:25 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| Segments | 1,051 | 1,004 | 2,027 | 960 | 3,203 | 0 | 3,182 | 2,738 | 432 | 606 | 1,935 |
| Minutes (5X) | 5,255 | 5,020 | 10,135 | 4,800 | 16,015 | 0 | 15,910 | 13,690 | 2,160 | 3,030 | 9,675 |
| Hours | 87.58 | 83.67 | 168.92 | 80.00 | 266.92 | 0.00 | 265.17 | 228.17 | 36.00 | 50.50 | 161.25 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - FEBRUARY 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 23:39:20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:44:20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:49:20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:54:20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:59:20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Segments | 451 | 3,273 | 724 | 499 | 1,837 | 0 | 1,887 | 1,555 | 3,041 | 956 | 616 |
| Minutes (5X) | 2,255 | 16,365 | 3,620 | 2,495 | 9,185 | 0 | 9,435 | 7,775 | 15,205 | 4,780 | 3,080 |
| Hours | 37.58 | 272.75 | 60.33 | 41.58 | 153.08 | 0.00 | 157.25 | 129.58 | 253.42 | 79.67 | 51.33 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - MARCH 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 22:20:28 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:25:28 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:30:28 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:35:28 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:40:28 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:45:28 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:50:28 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:55:28 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:00:28 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:05:28 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:10:28 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:15:28 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:20:28 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:25:28 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:30:28 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:35:28 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:40:28 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:45:28 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:50:28 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23:55:28 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Segments | 2,499 | 1,701 | 1,413 | 1,504 | 2,084 | 4 | 2,422 | 1,850 | 1,110 | 1,518 | 2,767 |
| Minutes (5X) | 12,495 | 8,505 | 7,065 | 7,520 | 10,420 | 20 | 12,110 | 9,250 | 5,550 | 7,590 | 13,835 |
| Hours | 208.25 | 141.75 | 117.75 | 125.33 | 173.67 | 0.33 | 201.83 | 154.17 | 92.50 | 126.50 | 230.58 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - APRIL 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 21:31:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:36:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:41:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:46:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:51:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:56:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:01:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:06:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:11:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:16:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:21:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:26:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:31:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:36:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:41:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:46:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:51:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:56:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:01:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:06:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:11:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:16:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:21:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:26:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:31:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:36:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:41:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:46:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:51:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:56:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Segments | 246 | 3,377 | 3,099 | 314 | 1,368 | 0 | 1,355 | 1,184 | 822 | 287 | 487 |
| Minutes (5X) | 1,230 | 16,885 | 15,495 | 1,570 | 6,840 | 0 | 6,775 | 5,920 | 4,110 | 1,435 | 2,435 |
| Hours | 20.50 | 281.42 | 258.25 | 26.17 | 114.00 | 0.00 | 112.92 | 98.67 | 68.50 | 23.92 | 40.58 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - MAY 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 20:42:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 20:47:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 20:52:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 20:57:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:02:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:07:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:12:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:17:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:22:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:27:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:32:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:37:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:42:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:47:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:52:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:57:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:02:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:07:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:12:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:17:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:22:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:27:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:32:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:37:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:42:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:47:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:52:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:57:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:02:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:07:07 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:12:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:17:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:22:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:27:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:32:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:37:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:42:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:47:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:52:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:57:07 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Segments | 714 | 711 | 719 | 703 | 2,253 | 1,627 | 1,582 | 2,248 | 1,280 | 716 | 514 |
| Minutes (5X) | 3,570 | 3,555 | 3,595 | 3,515 | 11,265 | 8,135 | 7,910 | 11,240 | 6,400 | 3,580 | 2,570 |
| Hours | 59.50 | 59.25 | 59.92 | 58.58 | 187.75 | 135.58 | 131.83 | 187.33 | 106.67 | 59.67 | 42.83 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - JUNE 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|-------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 22:56:24 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 23:01:24 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:06:24 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:11:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:16:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:21:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:26:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:31:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:36:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:41:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:46:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:51:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:56:24 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Segments | 1,864 | 1,905 | 1,894 | 1,856 | 2,618 | 2,045 | 1,931 | 988 | 2,407 | 1,850 | 1,896 |
| Minutes(5X) | 9,320 | 9,525 | 9,470 | 9,280 | 13,090 | 10,225 | 9,655 | 4,940 | 12,035 | 9,250 | 9,480 |
| Hours | 155.33 | 158.75 | 157.83 | 154.67 | 218.17 | 170.42 | 160.92 | 82.33 | 200.58 | 154.17 | 158.00 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - JULY 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 20:54:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:59:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:04:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:09:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:14:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:19:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:24:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:29:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:34:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:39:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:44:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:49:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:54:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:59:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:04:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:09:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:14:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:19:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:24:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:29:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:34:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:39:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:44:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:49:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:54:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:59:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:04:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:09:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:14:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:19:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:24:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:29:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:34:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:39:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:44:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:49:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:54:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:59:27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Segments | 2,137 | 2,118 | 2,537 | 2,105 | 2,096 | 2,496 | 2,149 | 1,895 | 1,645 | 2,097 | 562 |
| Minutes (5X) | 10,685 | 10,590 | 12,685 | 10,525 | 10,480 | 12,480 | 10,745 | 9,475 | 8,225 | 10,485 | 2,810 |
| Hours | 178.08 | 176.50 | 211.42 | 175.42 | 174.67 | 208.00 | 179.08 | 157.92 | 137.08 | 174.75 | 46.83 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - JUNE 1995

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 3:37:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3:42:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3:47:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3:52:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3:57:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:02:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:07:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:12:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:17:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:22:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:27:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:32:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:37:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:42:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:47:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:52:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4:57:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:02:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:07:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:12:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:17:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:22:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:27:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:32:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:37:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:42:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:47:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:52:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5:57:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:02:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:07:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:12:34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Segments | 794 | 723 | 1,240 | 815 | 1,540 | 734 | 1,084 | 0 | 882 | 807 | 801 |
| Minutes (5X) | 3,970 | 3,615 | 6,200 | 4,075 | 7,700 | 3,670 | 5,420 | 0 | 4,410 | 4,035 | 4,005 |
| Hours | 66.17 | 60.25 | 103.33 | 67.92 | 128.33 | 61.17 | 90.33 | 0.00 | 73.50 | 67.25 | 66.75 |

*Note: Telemetry data is incomplete and only covers from June 1 to June 12 (06:12)

Assume data is extrapolated to 30 days:

| | | | | | | | | | | | |
|---------|--------|--------|--------|--------|--------|--------|--------|------|--------|--------|--------|
| Minutes | 9,925 | 9,038 | 15,500 | 10,188 | 19,250 | 9,175 | 13,550 | 0 | 11,025 | 10,088 | 10,013 |
| Hours | 165.42 | 150.63 | 258.33 | 169.79 | 320.83 | 152.92 | 225.83 | 0.00 | 183.75 | 168.13 | 166.88 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - JULY 1995

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 23:41:22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 23:46:22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 23:51:22 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 23:56:22 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| Segments | 3,541 | 3,411 | 2,608 | 3,426 | 3,464 | 3,455 | 3,450 | 2,695 | 2,056 | 4,697 | 3,473 |
| Minutes (5X) | 17,705 | 17,055 | 13,040 | 17,130 | 17,320 | 17,275 | 17,250 | 13,475 | 10,280 | 23,485 | 17,365 |
| Hours | 295.08 | 284.25 | 217.33 | 285.50 | 288.67 | 287.92 | 287.50 | 224.58 | 171.33 | 391.42 | 289.42 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - AUGUST 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 21:27:40 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 21:32:40 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 21:37:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 21:42:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 21:47:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 21:52:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 21:57:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 22:02:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 22:07:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 22:12:40 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 22:17:40 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 22:22:40 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 22:27:40 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 22:32:40 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 22:37:40 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 22:42:39 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 22:47:39 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 22:52:39 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 22:57:39 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:02:39 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:07:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:12:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:17:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:22:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:27:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:32:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:37:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:42:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:47:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:52:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:57:39 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| Segments | 1,415 | 1,425 | 1,401 | 1,399 | 1,433 | 2,011 | 1,898 | 1,554 | 1,075 | 1,684 | 1,448 |
| Minutes (5X) | 7,075 | 7,125 | 7,005 | 6,995 | 7,165 | 10,055 | 9,490 | 7,770 | 5,375 | 8,420 | 7,240 |
| Hours | 117.92 | 118.75 | 116.75 | 116.58 | 119.42 | 167.58 | 158.17 | 129.50 | 89.58 | 140.33 | 120.67 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - SEPTEMBER 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 21:07:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:12:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:17:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:22:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:27:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:32:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:37:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:42:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:47:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:52:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21:57:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:02:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:07:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:12:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:17:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:22:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:27:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:32:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:37:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:42:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:47:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:52:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 22:57:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:02:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:07:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:12:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:17:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:22:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:27:02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:32:02 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:37:02 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:42:02 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:47:02 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:52:02 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 23:57:02 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Segments | 862 | 855 | 864 | 861 | 1,375 | 824 | 3,933 | 1,185 | 3,703 | 0 | 1,538 |
| Minutes (5X) | 4,310 | 4,275 | 4,320 | 4,305 | 6,875 | 4,120 | 19,665 | 5,925 | 18,515 | 0 | 7,690 |
| Hours | 71.83 | 71.25 | 72.00 | 71.75 | 114.58 | 68.67 | 327.75 | 98.75 | 308.58 | 0.00 | 128.17 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - OCTOBER 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 20:48:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 20:53:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 20:58:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:03:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:08:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:13:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:18:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:23:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:28:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:33:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:38:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:43:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:48:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:53:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 21:58:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:03:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:08:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:13:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:18:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:23:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:28:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:33:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:38:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:43:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:48:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:53:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 22:58:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:03:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:08:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:13:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:18:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:23:08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:28:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:33:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:38:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:43:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:48:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:53:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 23:58:07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Segments | 173 | 1,202 | 1,528 | 177 | 1,717 | 977 | 2,710 | 165 | 1,523 | 171 | 600 |
| Minutes (5X) | 865 | 6,010 | 7,640 | 885 | 8,585 | 4,885 | 13,550 | 825 | 7,615 | 855 | 3,000 |
| Hours | 14.42 | 100.17 | 127.33 | 14.75 | 143.08 | 81.42 | 225.83 | 13.75 | 126.92 | 14.25 | 50.00 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - NOVEMBER 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 5:58:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:03:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:08:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:13:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:18:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:23:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:28:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:33:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:38:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:43:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:48:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:53:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6:58:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:03:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:08:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:13:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:18:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:23:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:28:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:33:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:38:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:43:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:48:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:53:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7:58:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 8:03:23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Segments | 53 | 1,335 | 958 | 114 | 1,578 | 311 | 1,371 | 1,027 | 1,139 | 55 | 493 |
| Minutes (5X) | 265 | 6,675 | 4,790 | 570 | 7,890 | 1,555 | 6,855 | 5,135 | 5,695 | 275 | 2,465 |
| Hours | 4.42 | 111.25 | 79.83 | 9.50 | 131.50 | 25.92 | 114.25 | 85.58 | 94.92 | 4.58 | 41.08 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - DECEMBER 1994

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 23:49:18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:54:18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:59:18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Segments | 263 | 1,035 | 190 | 263 | 1,473 | 1,707 | 2,586 | 1,412 | 1,706 | 261 | 353 |
| Minutes (5X) | 1,315 | 5,175 | 950 | 1,315 | 7,365 | 8,535 | 12,930 | 7,060 | 8,530 | 1,305 | 1,765 |
| Hours | 21.92 | 86.25 | 15.83 | 21.92 | 122.75 | 142.25 | 215.50 | 117.67 | 142.17 | 21.75 | 29.42 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - JANUARY 1995

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 22:40:33 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 22:45:33 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 22:50:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 22:55:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:00:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 23:05:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:10:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:15:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:20:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:25:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:30:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:35:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:40:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:45:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:50:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 23:55:33 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| Segments | 1,150 | 1,314 | 1,323 | 1,167 | 1,322 | 2,337 | 3,085 | 950 | 1,693 | 1,163 | 207 |
| Minutes (5X) | 5,750 | 6,570 | 6,615 | 5,835 | 6,610 | 11,685 | 15,425 | 4,750 | 8,465 | 5,815 | 1,035 |
| Hours | 95.83 | 109.50 | 110.25 | 97.25 | 110.17 | 194.75 | 257.08 | 79.17 | 141.08 | 96.92 | 17.25 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - FEBRUARY 1995

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 22:32:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 22:37:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 22:42:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 22:47:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 22:52:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 22:57:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:02:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:07:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:12:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:17:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:22:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:27:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:32:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:37:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:42:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:47:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:52:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 23:57:56 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Segments | 594 | 1,118 | 1,276 | 594 | 706 | 1,908 | 1,401 | 1,304 | 1,027 | 584 | 1,618 |
| Minutes (5X) | 2,970 | 5,590 | 6,380 | 2,970 | 3,530 | 9,540 | 7,005 | 6,520 | 5,135 | 2,920 | 8,090 |
| Hours | 49.50 | 93.17 | 106.33 | 49.50 | 58.83 | 159.00 | 116.75 | 108.67 | 85.58 | 48.67 | 134.83 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - MARCH 1995

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 11:15:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:20:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:25:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:35:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:40:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:50:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:55:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:00:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:05:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:10:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:15:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:20:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:25:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:30:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:35:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:40:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:45:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:50:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:55:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:00:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:05:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:10:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:15:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:20:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:25:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:30:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:35:51 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 13:40:51 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 13:45:51 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 13:50:51 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 13:55:50 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 14:00:50 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 14:05:50 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 14:10:50 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 14:15:50 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Segments | 401 | 1,557 | 1,884 | 394 | 1,229 | 1,501 | 1,451 | 401 | 1,187 | 397 | 1,520 |
| Minutes (5X) | 2,005 | 7,785 | 9,420 | 1,970 | 6,145 | 7,505 | 7,255 | 2,005 | 5,935 | 1,985 | 7,600 |
| Hours | 33.42 | 129.75 | 157.00 | 32.83 | 102.42 | 125.08 | 120.92 | 33.42 | 98.92 | 33.08 | 126.67 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - APRIL 1995

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 20:32:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:37:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:42:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:47:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:52:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:57:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:02:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:07:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:12:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:17:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:22:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:27:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:32:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:37:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:42:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:47:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:52:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:57:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:02:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:07:29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:12:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:17:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:22:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:27:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:32:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:37:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:42:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:47:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:52:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:57:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:02:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:07:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:12:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:17:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:22:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:27:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:32:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:37:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:42:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:47:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:52:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:57:28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Segments | 215 | 1,470 | 1,273 | 214 | 1,457 | 1,632 | 1,452 | 114 | 231 | 219 | 1,592 |
| Minutes (5X) | 1,075 | 7,350 | 6,365 | 1,070 | 7,285 | 8,160 | 7,260 | 570 | 1,155 | 1,095 | 7,960 |
| Hours | 17.92 | 122.50 | 106.08 | 17.83 | 121.42 | 136.00 | 121.00 | 9.50 | 19.25 | 18.25 | 132.67 |

Water Conservation Study
Ft. Drum, NY

WELL OPERATING HOURS - MAY 1995

| | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| 22:44:07 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:49:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:54:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 22:59:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:04:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:09:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:14:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:19:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:24:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:29:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:34:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:39:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:44:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:49:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:54:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 23:59:07 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| Segments | 1,250 | 1,791 | 1,793 | 1,257 | 1,451 | 2,166 | 1,755 | 1,234 | 1,599 | 1,236 | 1,689 |
| Minutes (5X) | 6,250 | 8,955 | 8,965 | 6,285 | 7,255 | 10,830 | 8,775 | 6,170 | 7,995 | 6,180 | 8,445 |
| Hours | 104.17 | 149.25 | 149.42 | 104.75 | 120.92 | 180.50 | 146.25 | 102.83 | 133.25 | 103.00 | 140.75 |

DATALOG #3: MONTHLY WATER PRODUCTION

| Date | DANC Water (kGal) | Well Water (kGal) | Total Consumed (kGal) | Percentage of Water Purchased | Percentage of Well Water |
|------------|-------------------|-------------------|-----------------------|-------------------------------|--------------------------|
| Jan-93 | 51,616,589 | 11,074,049 | 62,690,638 | 82.34% | 17.66% |
| Feb-93 | 48,525,871 | 9,554,357 | 58,080,228 | 83.55% | 16.45% |
| Mar-93 | 54,756,724 | 9,717,674 | 64,474,398 | 84.93% | 15.07% |
| Apr-93 | 34,312,524 | 21,369,480 | 55,682,004 | 61.62% | 38.38% |
| May-93 | 39,371,133 | 14,650,554 | 54,021,687 | 72.88% | 27.12% |
| Jun-93 | 44,752,142 | 14,612,138 | 59,364,280 | 75.39% | 24.61% |
| Jul-93 | 46,983,562 | 22,891,369 | 69,874,931 | 67.24% | 32.76% |
| Aug-93 | 49,012,266 | 21,012,469 | 70,024,735 | 69.99% | 30.01% |
| Sep-93 | 43,348,871 | 17,874,997 | 61,223,868 | 70.80% | 29.20% |
| | | | | | |
| Oct-93 | 42,437,705 | 16,372,653 | 58,810,358 | 72.16% | 27.84% |
| Nov-93 | 36,935,479 | 9,506,089 | 46,441,568 | 79.53% | 20.47% |
| Dec-93 | 46,136,198 | 11,868,428 | 58,004,626 | 79.54% | 20.46% |
| Jan-94 | 48,199,330 | 13,741,064 | 61,940,394 | 77.82% | 22.18% |
| Feb-94 | 40,084,913 | 12,090,284 | 52,175,197 | 76.83% | 23.17% |
| Mar-94 | 47,327,854 | 14,702,874 | 62,030,728 | 76.30% | 23.70% |
| Apr-94 | 41,173,157 | 8,610,372 | 49,783,529 | 82.70% | 17.30% |
| May-94 | 44,739,281 | 11,046,712 | 55,785,993 | 80.20% | 19.80% |
| Jun-94 | 44,332,395 | 21,861,312 | 66,193,707 | 66.97% | 33.03% |
| Jul-94 | 44,844,363 | 24,990,738 | 69,835,101 | 64.21% | 35.79% |
| Aug-94 | 48,470,775 | 16,821,081 | 65,291,856 | 74.24% | 25.76% |
| Sep-94 | 37,238,629 | 12,293,227 | 49,531,856 | 75.18% | 24.82% |
| FY-94 | 521,920,079 | 173,904,834 | 695,824,913 | 75.01% | 24.99% |
| | | | | | |
| Oct-94 | 37,598,335 | 7,061,956 | 44,660,291 | 84.19% | 15.81% |
| Nov-94 | 36,025,164 | 6,276,778 | 42,301,942 | 85.16% | 14.84% |
| Dec-94 | 45,834,444 | 8,138,277 | 53,972,721 | 84.92% | 15.08% |
| Jan-95 | 46,724,846 | 13,963,662 | 60,688,508 | 76.99% | 23.01% |
| Feb-95 | 41,439,819 | 10,331,624 | 51,771,443 | 80.04% | 19.96% |
| Mar-95 | 46,081,841 | 9,951,516 | 56,033,357 | 82.24% | 17.76% |
| Apr-95 | 45,236,781 | 7,948,643 | 53,185,424 | 85.05% | 14.95% |
| May-95 | 48,093,488 | 16,479,461 | 64,572,949 | 74.48% | 25.52% |
| Jun-95 | 49,966,108 | 33,718,660 | 83,684,768 | 59.71% | 40.29% |
| Jul-95 | 46,753,343 | 33,903,043 | 80,656,386 | 57.97% | 42.03% |
| * Aug-95 | 45,425,295 | 32,655,708 | 78,081,003 | 58.18% | 41.82% |
| * Sep-95 | 44,865,012 | 22,623,044 | 67,488,056 | 66.48% | 33.52% |
| FY-95 | 534,044,476 | 203,052,372 | 737,096,848 | 72.45% | 27.55% |
| 2 Yr. Avg. | 527,982,278 | 188,478,603 | 716,460,881 | 73.69% | 26.31% |

| | DANC | Ft. Drum |
|------------------|--------------------|--------------------|
| Aug-93 to Jul-94 | 528,571,812 | 183,677,992 |
| Aug-94 to Jul-95 | 529,463,573 | 176,887,928 |
| Average | 529,017,693 | 180,282,960 |

*Note: Incomplete telemetry data available for this month. Value taken from DANC usage figures.

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| Low | 0 | 0 | 0 | |
| High | 3,000,000 | 2,500,000 | 300 | |
| 1-Jan-93 | 2,464,689 | 71,873 | 187 | |
| 2-Jan-93 | 2,646,006 | 5,322 | 187 | |
| 3-Jan-93 | 3,000,000 | 7,079 | 184 | |
| 4-Jan-93 | 3,000,000 | 7,136 | 197 | |
| 5-Jan-93 | 2,139,894 | 401,727 | 185 | |
| 6-Jan-93 | 1,501,854 | 325,119 | 184 | |
| 7-Jan-93 | 1,500,468 | 460,767 | 130 | |
| 8-Jan-93 | 1,501,085 | 390,155 | 130 | |
| 9-Jan-93 | 1,787,552 | 68,120 | 131 | |
| 10-Jan-93 | 1,777,902 | 7,238 | 131 | |
| 11-Jan-93 | 1,848,008 | 26,053 | 130 | |
| 12-Jan-93 | 1,317,172 | 294,257 | 128 | |
| 13-Jan-93 | 1,299,831 | 314,103 | 131 | |
| 14-Jan-93 | 1,281,773 | 376,324 | 129 | |
| 15-Jan-93 | 1,200,743 | 516,336 | 133 | |
| 16-Jan-93 | 626,165 | 936,186 | 137 | |
| 17-Jan-93 | 9 | 1,479,099 | 142 | |
| 18-Jan-93 | 1,578,597 | 131,850 | 142 | |
| 19-Jan-93 | 2,351,767 | 26,631 | 141 | |
| 20-Jan-93 | 1,019,282 | 608,537 | 142 | |
| 21-Jan-93 | 1,387,055 | 611,708 | 142 | |
| 22-Jan-93 | 1,163,375 | 545,611 | 141 | |
| 23-Jan-93 | 1,501,535 | 506,566 | 142 | |
| 24-Jan-93 | 2,179,896 | 89,227 | 140 | |
| 25-Jan-93 | 2,216,224 | 4,417 | 140 | |
| 26-Jan-93 | 1,500,885 | 436,870 | 139 | |
| 27-Jan-93 | 1,500,748 | 732,469 | 140 | |
| 28-Jan-93 | 1,502,838 | 654,690 | 141 | |
| 29-Jan-93 | 1,502,517 | 499,572 | 141 | |
| 30-Jan-93 | 1,577,726 | 417,588 | 143 | |
| 31-Jan-93 | 1,740,993 | 121,419 | 128 | |
| Monthly Total | 51,616,589 | 11,074,049 | 4,538 | 62,690,637 |
| 1-Feb-93 | 2,334,464 | 119,591 | 128 | |
| 2-Feb-93 | 1,945,400 | 508,342 | 122 | |
| 3-Feb-93 | 1,791,460 | 489,806 | 122 | |
| 4-Feb-93 | 1,342,397 | 343,682 | 122 | |
| 5-Feb-93 | 1,505,788 | 338,436 | 121 | |
| 6-Feb-93 | 2,181,037 | 103,386 | 122 | |
| 7-Feb-93 | 1,988,380 | 8,645 | 120 | |
| 8-Feb-93 | 2,609,532 | 8,862 | 115 | |
| 9-Feb-93 | 1,510,185 | 798,927 | 120 | |
| 10-Feb-93 | 1,511,729 | 822,321 | 122 | |
| 11-Feb-93 | 1,592,068 | 652,939 | 122 | |
| 12-Feb-93 | 1,510,411 | 529,983 | 122 | |
| 13-Feb-93 | 2,041,241 | 79,621 | 128 | |
| 14-Feb-93 | 1,944,435 | 5,929 | 133 | |
| 15-Feb-93 | 1,910,808 | 6,058 | 134 | |
| 16-Feb-93 | 2,089,144 | 0 | 132 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 17-Feb-93 | 1,489,606 | 375,314 | 129 | |
| 18-Feb-93 | 1,521,609 | 526,149 | 129 | |
| 19-Feb-93 | 1,402,857 | 492,297 | 128 | |
| 20-Feb-93 | 1,979,598 | 80,464 | 127 | |
| 21-Feb-93 | 2,041,523 | 3,809 | 125 | |
| 22-Feb-93 | 2,132,905 | 4,625 | 151 | |
| 23-Feb-93 | 1,253,095 | 635,898 | 126 | |
| 24-Feb-93 | 946,352 | 914,810 | 126 | |
| 25-Feb-93 | 941,176 | 960,673 | 128 | |
| 26-Feb-93 | 1,249,475 | 718,661 | 127 | |
| 27-Feb-93 | 1,811,340 | 20,504 | 128 | |
| 28-Feb-93 | 1,947,856 | 4,624 | 126 | |
| Monthly Total | 48,525,871 | 9,554,357 | 3,535 | 58,080,228 |
| 1-Mar-93 | 2,184,307 | 4,984 | 126 | |
| 2-Mar-93 | 1,501,177 | 381,876 | 130 | |
| 4-Mar-93 | 1,509,401 | 555,575 | 133 | |
| 5-Mar-93 | 1,501,070 | 531,703 | 133 | |
| 6-Mar-93 | 2,534,292 | 50,105 | 134 | |
| 7-Mar-93 | 2,544,535 | 1,360 | 133 | |
| 8-Mar-93 | 2,592,456 | 1,547 | 133 | |
| 9-Mar-93 | 1,500,443 | 355,475 | 133 | |
| 10-Mar-93 | 1,500,394 | 702,649 | 134 | |
| 11-Mar-93 | 1,501,758 | 687,380 | 135 | |
| 12-Mar-93 | 1,501,581 | 608,685 | 136 | |
| 13-Mar-93 | 2,125,132 | 99,159 | 138 | |
| 14-Mar-93 | 1,996,070 | 2,506 | 141 | |
| 15-Mar-93 | 2,579,889 | 4,309 | 139 | |
| 16-Mar-93 | 1,502,182 | 291,938 | 140 | |
| 17-Mar-93 | 1,563,608 | 709,725 | 143 | |
| 18-Mar-93 | 1,726,787 | 654,017 | 141 | |
| 19-Mar-93 | 1,700,403 | 343,587 | 139 | |
| 20-Mar-93 | 1,975,275 | 76,839 | 142 | |
| 21-Mar-93 | 1,846,842 | 3,999 | 143 | |
| 22-Mar-93 | 2,065,003 | 0 | 145 | |
| 23-Mar-93 | 1,501,536 | 373,463 | 143 | |
| 24-Mar-93 | 1,500,662 | 394,425 | 146 | |
| 25-Mar-93 | 1,500,745 | 651,499 | 146 | |
| 26-Mar-93 | 1,535,150 | 565,280 | 146 | |
| 27-Mar-93 | 2,010,744 | 105,794 | 146 | |
| 28-Mar-93 | 2,335,720 | 970 | 146 | |
| 29-Mar-93 | 2,318,396 | 0 | 146 | |
| 30-Mar-93 | 1,501,830 | 722,211 | 145 | |
| 31-Mar-93 | 1,099,336 | 836,614 | 156 | |
| Monthly Total | 54,758,724 | 9,717,674 | 4,191 | 64,474,398 |
| 1-Apr-93 | 1,064,618 | 731,100 | 175 | |
| 2-Apr-93 | 1,496,589 | 445,972 | 164 | |
| 3-Apr-93 | 1,267,605 | 638,925 | 155 | |
| 4-Apr-93 | 1,944,367 | 3 | 154 | |
| 5-Apr-93 | 2,084,071 | 278 | 147 | |
| 6-Apr-93 | 1,155,357 | 958,027 | 152 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 7-Apr-93 | 1,099,776 | 488,614 | 114 | |
| 8-Apr-93 | 998,402 | 716,813 | 153 | |
| 9-Apr-93 | 1,259,944 | 613,839 | 153 | |
| 10-Apr-93 | 1,107,054 | 673,935 | 159 | |
| 11-Apr-93 | 1,993,171 | 370 | 161 | |
| 12-Apr-93 | 2,090,336 | 0 | 157 | |
| 13-Apr-93 | 1,175,638 | 668,192 | 157 | |
| 14-Apr-93 | 1,175,203 | 709,384 | 156 | |
| 15-Apr-93 | 1,148,637 | 809,192 | 157 | |
| 16-Apr-93 | 501,667 | 1,231,067 | 160 | |
| 17-Apr-93 | 601,653 | 1,104,827 | 157 | |
| 18-Apr-93 | 1,738,532 | 119 | 153 | |
| 19-Apr-93 | 2,121,165 | 0 | 152 | |
| 20-Apr-93 | 500,489 | 1,097,285 | 156 | |
| 21-Apr-93 | 501,892 | 1,130,635 | 153 | |
| 22-Apr-93 | 500,513 | 1,304,898 | 158 | |
| 23-Apr-93 | 501,855 | 1,322,979 | 147 | |
| 24-Apr-93 | 547,942 | 1,235,820 | 145 | |
| 25-Apr-93 | 2,023,485 | 0 | 143 | |
| 26-Apr-93 | 1,873,847 | 0 | 149 | |
| 27-Apr-93 | 500,665 | 1,324,849 | 149 | |
| 28-Apr-93 | 501,050 | 1,342,792 | 145 | |
| 29-Apr-93 | 500,658 | 1,397,587 | 144 | |
| 30-Apr-93 | 336,343 | 1,421,977 | 150 | |
| Monthly Total | 34,312,524 | 21,369,480 | 4,575 | 55,682,004 |
| 1-May-93 | 500,866 | 1,105,068 | 149 | |
| 2-May-93 | 1,846,626 | 1,285 | 148 | |
| 3-May-93 | 1,994,750 | 545 | 146 | |
| 4-May-93 | 500,882 | 1,267,056 | 145 | |
| 5-May-93 | 501,916 | 1,562,402 | 145 | |
| 6-May-93 | 1,400,673 | 748,718 | 146 | |
| 7-May-93 | 1,409,133 | 498,755 | 145 | |
| 8-May-93 | 1,535,244 | 426,841 | 130 | |
| 9-May-93 | 1,911,199 | 3,388 | 123 | |
| 10-May-93 | 2,002,557 | 2,704 | 121 | |
| 11-May-93 | 1,294,427 | 621,844 | 119 | |
| 12-May-93 | 1,303,092 | 531,270 | 118 | |
| 13-May-93 | 1,345,622 | 656,893 | 117 | |
| 14-May-93 | 1,281,494 | 877,797 | 114 | |
| 15-May-93 | 1,279,678 | 740,557 | 113 | |
| 16-May-93 | 1,772,883 | 51,521 | 112 | |
| 17-May-93 | 1,953,386 | 4,638 | 109 | |
| 18-May-93 | 1,092,924 | 565,151 | 110 | |
| 19-May-93 | 1,092,281 | 844,924 | 114 | |
| 20-May-93 | 1,091,891 | 764,263 | 116 | |
| 21-May-93 | 1,093,288 | 887,405 | 113 | |
| 22-May-93 | 1,212,138 | 843,900 | 112 | |
| 23-May-93 | 1,955,562 | 773 | 115 | |
| 24-May-93 | 2,278,001 | 0 | 114 | |
| 25-May-93 | 1,199,788 | 734,046 | 114 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 29-May-93 | 809,388 | 908,811 | 116 | |
| 30-May-93 | 1,809,821 | 0 | 115 | |
| 31-May-93 | 1,901,623 | 0 | 113 | |
| Monthly Total | 39,371,133 | 14,650,554 | 3,452 | 54,021,687 |
| 1-Jun-93 | 2,121,449 | 0 | 114 | |
| 2-Jun-93 | 400,792 | 1,361,914 | 115 | |
| 3-Jun-93 | 1,427,249 | 806,590 | 118 | |
| 4-Jun-93 | 1,423,590 | 842,030 | 115 | |
| 5-Jun-93 | 1,129,698 | 593,032 | 113 | |
| 6-Jun-93 | 1,542,591 | 4,303 | 113 | |
| 7-Jun-93 | 1,912,030 | 461 | 115 | |
| 8-Jun-93 | 1,469,747 | 310,566 | 114 | |
| 9-Jun-93 | 1,315,101 | 441,627 | 115 | |
| 10-Jun-93 | 1,337,840 | 425,000 | 115 | |
| 11-Jun-93 | 1,400,000 | 420,000 | 115 | |
| 12-Jun-93 | 1,894,467 | 508,712 | 107 | |
| 13-Jun-93 | 2,879,290 | 0 | 110 | |
| 14-Jun-93 | 2,796,047 | 0 | 111 | |
| 15-Jun-93 | 871,702 | 1,089,278 | 108 | |
| 16-Jun-93 | 870,023 | 942,724 | 109 | |
| 17-Jun-93 | 870,110 | 964,262 | 107 | |
| 18-Jun-93 | 869,901 | 1,061,125 | 105 | |
| 19-Jun-93 | 868,703 | 843,740 | 99 | |
| 20-Jun-93 | 1,775,450 | 120 | 104 | |
| 21-Jun-93 | 1,907,885 | 0 | 105 | |
| 22-Jun-93 | 1,428,370 | 344,477 | 106 | |
| 23-Jun-93 | 1,438,833 | 297,850 | 105 | |
| 24-Jun-93 | 1,477,630 | 548,509 | 104 | |
| 25-Jun-93 | 1,478,148 | 513,759 | 103 | |
| 26-Jun-93 | 1,672,912 | 574,463 | 103 | |
| 27-Jun-93 | 1,828,374 | 528 | 105 | |
| 28-Jun-93 | 1,905,485 | 0 | 105 | |
| 29-Jun-93 | 1,220,116 | 625,087 | 106 | |
| 30-Jun-93 | 1,218,609 | 1,091,981 | 102 | |
| Monthly Total | 44,752,142 | 14,612,138 | 3,266 | 59,364,280 |
| 1-Jul-93 | 1,218,911 | 1,011,344 | 101 | |
| 2-Jul-93 | 1,218,410 | 999,237 | 102 | |
| 3-Jul-93 | 1,391,336 | 482,040 | 99 | |
| 4-Jul-93 | 1,926,642 | 0 | 98 | |
| 5-Jul-93 | 1,939,423 | 0 | 99 | |
| 6-Jul-93 | 2,235,181 | 0 | 98 | |
| 7-Jul-93 | 1,219,668 | 813,493 | 99 | |
| 8-Jul-93 | 1,218,768 | 849,883 | 98 | |
| 9-Jul-93 | 1,219,823 | 986,647 | 99 | |
| 10-Jul-93 | 1,356,600 | 796,762 | 97 | |
| 11-Jul-93 | 2,214,023 | 3,848 | 89 | |
| 12-Jul-93 | 2,601,163 | 0 | 88 | |
| 13-Jul-93 | 1,219,814 | 693,959 | 90 | |
| 14-Jul-93 | 1,219,664 | 811,126 | 88 | |
| 15-Jul-93 | 1,019,857 | 902,785 | 90 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 16-Jul-93 | 808,180 | 1,275,951 | 91 | |
| 17-Jul-93 | 981,769 | 1,212,507 | 89 | |
| 18-Jul-93 | 2,083,197 | 1,378 | 88 | |
| 19-Jul-93 | 2,581,807 | 0 | 87 | |
| 20-Jul-93 | 1,023,174 | 1,116,360 | 88 | |
| 21-Jul-93 | 1,110,159 | 1,332,652 | 87 | |
| 22-Jul-93 | 1,108,178 | 1,172,548 | 84 | |
| 23-Jul-93 | 1,109,114 | 1,027,797 | 84 | |
| 24-Jul-93 | 1,369,562 | 647,680 | 85 | |
| 25-Jul-93 | 2,340,203 | 2,205 | 85 | |
| 26-Jul-93 | 2,570,189 | 554 | 86 | |
| 27-Jul-93 | 1,027,482 | 1,367,698 | 86 | |
| 28-Jul-93 | 1,330,275 | 1,949,791 | 87 | |
| 29-Jul-93 | 2,031,429 | 1,347,705 | 86 | |
| 30-Jul-93 | 1,441,071 | 1,077,955 | 89 | |
| 31-Jul-93 | 848,490 | 1,007,464 | 86 | |
| Monthly Total | 46,983,562 | 22,891,369 | 2,823 | 69,874,931 |
| 1-Aug-93 | 1,921,942 | 3,996 | 88 | |
| 2-Aug-93 | 2,181,404 | 0 | 86 | |
| 3-Aug-93 | 1,182,711 | 865,583 | 85 | |
| 4-Aug-93 | 1,311,528 | 901,037 | 85 | |
| 5-Aug-93 | 1,000,103 | 1,054,928 | 84 | |
| 6-Aug-93 | 1,175,085 | 959,765 | 85 | |
| 7-Aug-93 | 1,134,151 | 1,038,274 | 88 | |
| 8-Aug-93 | 1,941,151 | 3,388 | 87 | |
| 9-Aug-93 | 2,239,900 | 0 | 88 | |
| 10-Aug-93 | 1,198,067 | 899,373 | 86 | |
| 11-Aug-93 | 1,200,579 | 1,069,665 | 86 | |
| 12-Aug-93 | 1,002,013 | 1,023,247 | 84 | |
| 13-Aug-93 | 1,602,019 | 958,155 | 84 | |
| 14-Aug-93 | 1,500,471 | 1,004,203 | 81 | |
| 15-Aug-93 | 2,331,396 | 1,045 | 82 | |
| 16-Aug-93 | 2,384,745 | 0 | 83 | |
| 17-Aug-93 | 1,001,804 | 1,298,458 | 81 | |
| 18-Aug-93 | 2,266,025 | 290,462 | 81 | |
| 19-Aug-93 | 1,200,812 | 1,027,124 | 81 | |
| 20-Aug-93 | 1,000,804 | 1,100,655 | 84 | |
| 21-Aug-93 | 1,588,904 | 802,546 | 83 | |
| 22-Aug-93 | 1,741,397 | 2,642 | 81 | |
| 23-Aug-93 | 2,451,364 | 479 | 80 | |
| 24-Aug-93 | 1,124,910 | 900,194 | 80 | |
| 25-Aug-93 | 1,186,373 | 1,120,784 | 82 | |
| 26-Aug-93 | 802,258 | 1,369,860 | 84 | |
| 27-Aug-93 | 1,047,111 | 1,279,732 | 85 | |
| 28-Aug-93 | 1,816,744 | 1,214,440 | 82 | |
| 29-Aug-93 | 2,225,817 | 0 | 87 | |
| 30-Aug-93 | 2,630,050 | 0 | 86 | |
| 31-Aug-93 | 1,620,628 | 822,435 | 85 | |
| Monthly Total | 49,012,266 | 21,012,469 | 2,604 | 70,024,735 |
| 1-Sep-93 | 901,877 | 1,261,883 | 89 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 2-Sep-93 | 1,356,033 | 867,695 | 90 | |
| 3-Sep-93 | 1,196,135 | 921,879 | 93 | |
| 4-Sep-93 | 1,382,528 | 766,813 | 94 | |
| 5-Sep-93 | 1,811,220 | 0 | 92 | |
| 6-Sep-93 | 1,225,493 | 484,379 | 91 | |
| 7-Sep-93 | 2,072,158 | 3,031 | 92 | |
| 8-Sep-93 | 1,430,154 | 931,934 | 91 | |
| 9-Sep-93 | 1,444,991 | 794,604 | 87 | |
| 10-Sep-93 | 904,557 | 1,047,826 | 88 | |
| 11-Sep-93 | 1,119,198 | 819,249 | 86 | |
| 12-Sep-93 | 1,752,570 | 0 | 84 | |
| 13-Sep-93 | 2,166,854 | 0 | 89 | |
| 14-Sep-93 | 1,476,266 | 650,460 | 93 | |
| 15-Sep-93 | 1,443,293 | 1,002,785 | 104 | |
| 16-Sep-93 | 1,443,130 | 990,458 | 90 | |
| 17-Sep-93 | 1,357,882 | 916,740 | 82 | |
| 18-Sep-93 | 1,329,166 | 829,923 | 78 | |
| 19-Sep-93 | 1,647,587 | 0 | 78 | |
| 20-Sep-93 | 2,086,556 | 375 | 76 | |
| 21-Sep-93 | 2,168,444 | 12,881 | 74 | |
| 22-Sep-93 | 1,153,489 | 908,744 | 84 | |
| 23-Sep-93 | 1,149,271 | 857,603 | 66 | |
| 24-Sep-93 | 1,149,118 | 871,759 | 66 | |
| 25-Sep-93 | 1,146,889 | 710,602 | 69 | |
| 26-Sep-93 | 1,711,663 | 5,793 | 66 | |
| 27-Sep-93 | 1,973,469 | 4,321 | 64 | |
| 28-Sep-93 | 1,154,000 | 1,025,685 | 66 | |
| 29-Sep-93 | 1,135,881 | 397,052 | 66 | |
| 30-Sep-93 | 1,058,999 | 790,523 | 66 | |
| Monthly Total | 43,348,871 | 17,874,997 | 2,454 | 61,223,868 |
| 1-Oct-93 | 972,772 | 1,059,018 | 66 | |
| 2-Oct-93 | 1,053,525 | 1,103,270 | 67 | |
| 3-Oct-93 | 2,704,764 | 0 | 65 | |
| 4-Oct-93 | 2,748,211 | 0 | 66 | |
| 5-Oct-93 | 1,430,209 | 380,925 | 66 | |
| 6-Oct-93 | 128,979 | 1,212,375 | 67 | |
| 7-Oct-93 | 1,710,797 | 432,124 | 66 | |
| 8-Oct-93 | 1,461,533 | 372,338 | 64 | |
| 9-Oct-93 | 733,221 | 840,673 | 67 | |
| 10-Oct-93 | 1,783,129 | 0 | 65 | |
| 11-Oct-93 | 1,739,160 | 0 | 65 | |
| 12-Oct-93 | 2,182,112 | 0 | 66 | |
| 13-Oct-93 | 1,042,465 | 1,042,565 | 64 | |
| 14-Oct-93 | 1,070,771 | 907,471 | 65 | |
| 15-Oct-93 | 812,023 | 951,161 | 66 | |
| 16-Oct-93 | 843,073 | 878,381 | 65 | |
| 17-Oct-93 | 1,716,208 | 0 | 67 | |
| 18-Oct-93 | 1,904,262 | 82 | 67 | |
| 19-Oct-93 | 868,848 | 904,225 | 65 | |
| 20-Oct-93 | 793,905 | 908,923 | 69 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 21-Oct-93 | 860,597 | 946,237 | 69 | |
| 22-Oct-93 | 1,479,983 | 666,759 | 70 | |
| 23-Oct-93 | 1,064,481 | 575,092 | 71 | |
| 24-Oct-93 | 1,683,333 | 0 | 70 | |
| 25-Oct-93 | 2,029,200 | 0 | 73 | |
| 26-Oct-93 | 778,266 | 977,557 | 74 | |
| 27-Oct-93 | 1,479,784 | 499,894 | 75 | |
| 28-Oct-93 | 911,439 | 726,937 | 79 | |
| 29-Oct-93 | 1,487,811 | 522,873 | 80 | |
| 30-Oct-93 | 1,233,503 | 463,052 | 82 | |
| 31-Oct-93 | 1,729,341 | 721 | 86 | |
| Monthly Total | 42,437,705 | 16,372,653 | 2,147 | 58,810,358 |
| 1-Nov-93 | 2,023,697 | 0 | 91 | |
| 2-Nov-93 | 1,508,617 | 646,499 | 103 | |
| 3-Nov-93 | 1,179,945 | 551,825 | 92 | |
| 4-Nov-93 | 1,320,179 | 580,718 | 96 | |
| 5-Nov-93 | 1,346,341 | 561,856 | 96 | |
| 6-Nov-93 | 1,167,820 | 536,733 | 101 | |
| 7-Nov-93 | 1,503,100 | 10,733 | 94 | |
| 8-Nov-93 | 1,776,007 | 356 | 95 | |
| 9-Nov-93 | 848,233 | 907,002 | 95 | |
| 10-Nov-93 | 1,101,974 | 856,451 | 110 | |
| 11-Nov-93 | 732,129 | 946,990 | 98 | |
| 12-Nov-93 | 1,297,019 | 43,215 | 108 | |
| 13-Nov-93 | 1,718,960 | 1,988 | 102 | |
| 14-Nov-93 | 1,545,091 | 733 | 106 | |
| 15-Nov-93 | 1,847,006 | 618 | 99 | |
| 16-Nov-93 | 1,119,535 | 418,659 | 95 | |
| 17-Nov-93 | 1,182,585 | 512,539 | 101 | |
| 18-Nov-93 | 819,700 | 403,080 | 102 | |
| 19-Nov-93 | 959,370 | 372,893 | 105 | |
| 20-Nov-93 | 1,148,648 | 381,535 | 98 | |
| 21-Nov-93 | 1,629,701 | 1,955 | 100 | |
| 22-Nov-93 | 1,577,002 | 2,782 | 100 | |
| 23-Nov-93 | 1,438,719 | 610,658 | 101 | |
| 24-Nov-93 | 1,267,552 | 538,733 | 99 | |
| 25-Nov-93 | 1,426,500 | 218,472 | 102 | |
| 26-Nov-93 | 450,049 | 2,828 | 98 | |
| 27-Nov-93 | 0 | 4,115 | 101 | |
| 28-Nov-93 | 0 | 4,070 | 115 | |
| 29-Nov-93 | 3,000,000 | 1,257 | 101 | |
| 30-Nov-93 | 0 | 386,797 | 105 | |
| Monthly Total | 36,935,479 | 9,506,089 | 3,009 | 46,441,568 |
| 1-Dec-93 | 1,533,573 | 300,603 | 109 | |
| 2-Dec-93 | 1,451,778 | 283,902 | 105 | |
| 3-Dec-93 | 1,296,810 | 274,568 | 103 | |
| 4-Dec-93 | 1,761,085 | 566,894 | 103 | |
| 5-Dec-93 | 3,000,000 | 156,063 | 101 | |
| 6-Dec-93 | 1,977,928 | 2,760 | 101 | |
| 7-Dec-93 | 1,737,184 | 486,684 | 98 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 8-Dec-93 | 1,075,774 | 904,725 | 102 | |
| 9-Dec-93 | 1,200,282 | 783,857 | 101 | |
| 10-Dec-93 | 1,000,375 | 804,054 | 103 | |
| 11-Dec-93 | 694,374 | 961,470 | 105 | |
| 12-Dec-93 | 1,705,008 | 23,433 | 105 | |
| 13-Dec-93 | 1,779,247 | 4,629 | 101 | |
| 14-Dec-93 | 720,084 | 993,968 | 105 | |
| 15-Dec-93 | 583,601 | 967,812 | 106 | |
| 16-Dec-93 | 685,242 | 961,582 | 105 | |
| 17-Dec-93 | 1,267,266 | 365,612 | 108 | |
| 18-Dec-93 | 1,009,163 | 428,951 | 105 | |
| 19-Dec-93 | 1,460,147 | 14,978 | 101 | |
| 20-Dec-93 | 1,573,540 | 2,834 | 104 | |
| 21-Dec-93 | 1,299,185 | 363,184 | 103 | |
| 22-Dec-93 | 1,213,921 | 300,208 | 102 | |
| 23-Dec-93 | 1,350,908 | 255,209 | 104 | |
| 24-Dec-93 | 1,340,956 | 131,555 | 107 | |
| 25-Dec-93 | 1,588,237 | 4,087 | 101 | |
| 26-Dec-93 | 1,677,906 | 2,402 | 104 | |
| 27-Dec-93 | 2,487,111 | 115,758 | 102 | |
| 28-Dec-93 | 1,791,042 | 377,889 | 107 | |
| 29-Dec-93 | 1,996,786 | 505,816 | 109 | |
| 30-Dec-93 | 1,907,203 | 406,766 | 103 | |
| 31-Dec-93 | 1,970,482 | 116,175 | 103 | |
| Monthly Total | 46,136,198 | 11,868,428 | 3,216 | 58,004,626 |
| 1-Jan-94 | 2,141,288 | 4,523 | 103 | |
| 2-Jan-94 | 2,409,099 | 3,674 | 105 | |
| 3-Jan-94 | 2,770,191 | 5,043 | 106 | |
| 4-Jan-94 | 1,061,906 | 711,723 | 111 | |
| 5-Jan-94 | 826,173 | 870,852 | 125 | |
| 6-Jan-94 | 786,132 | 1,152,308 | 132 | |
| 7-Jan-94 | 585,325 | 1,045,484 | 124 | |
| 8-Jan-94 | 1,145,206 | 597,156 | 122 | |
| 9-Jan-94 | 1,643,197 | 48,732 | 120 | |
| 10-Jan-94 | 2,068,136 | 5,894 | 117 | |
| 11-Jan-94 | 1,431,000 | 328,196 | 118 | |
| 12-Jan-94 | 1,430,804 | 666,945 | 122 | |
| 13-Jan-94 | 1,391,421 | 751,182 | 120 | |
| 14-Jan-94 | 1,048,325 | 582,190 | 121 | |
| 15-Jan-94 | 1,209,586 | 421,496 | 121 | |
| 16-Jan-94 | 1,795,123 | 5,509 | 117 | |
| 17-Jan-94 | 1,855,467 | 8,524 | 119 | |
| 18-Jan-94 | 2,531,379 | 7,186 | 119 | |
| 19-Jan-94 | 1,217,803 | 468,487 | 119 | |
| 20-Jan-94 | 1,903,763 | 501,815 | 117 | |
| 21-Jan-94 | 1,600,426 | 436,107 | 117 | |
| 22-Jan-94 | 1,488,363 | 402,841 | 120 | |
| 23-Jan-94 | 2,001,735 | 4,548 | 120 | |
| 24-Jan-94 | 1,932,504 | 6,795 | 121 | |
| 25-Jan-94 | 1,225,798 | 875,603 | 122 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 26-Jan-94 | 927,289 | 836,347 | 119 | |
| 27-Jan-94 | 930,122 | 1,000,197 | 114 | |
| 28-Jan-94 | 882,081 | 945,484 | 121 | |
| 29-Jan-94 | 1,302,270 | 1,035,277 | 128 | |
| 30-Jan-94 | 2,222,093 | 4,207 | 126 | |
| 31-Jan-94 | 2,435,325 | 6,736 | 123 | |
| Monthly Total | 48,199,330 | 13,741,064 | 3,689 | 61,940,394 |
| 1-Feb-94 | 445,642 | 1,617,307 | 122 | |
| 2-Feb-94 | 1,500,640 | 587,263 | 121 | |
| 3-Feb-94 | 1,314,385 | 648,633 | 122 | |
| 4-Feb-94 | 1,152,730 | 568,252 | 123 | |
| 5-Feb-94 | 1,154,348 | 581,776 | 121 | |
| 6-Feb-94 | 1,778,975 | 12,409 | 122 | |
| 7-Feb-94 | 1,917,463 | 4,221 | 120 | |
| 8-Feb-94 | 1,186,175 | 597,474 | 119 | |
| 9-Feb-94 | 1,215,372 | 545,305 | 121 | |
| 10-Feb-94 | 1,210,242 | 538,667 | 121 | |
| 11-Feb-94 | 1,243,126 | 519,749 | 121 | |
| 12-Feb-94 | 1,286,041 | 385,993 | 122 | |
| 13-Feb-94 | 1,789,666 | 4,613 | 119 | |
| 14-Feb-94 | 1,959,667 | 5,144 | 120 | |
| 15-Feb-94 | 1,349,419 | 455,811 | 119 | |
| 16-Feb-94 | 1,161,154 | 428,243 | 123 | |
| 17-Feb-94 | 1,440,070 | 405,527 | 122 | |
| 18-Feb-94 | 1,310,852 | 415,960 | 123 | |
| 19-Feb-94 | 1,160,103 | 474,624 | 121 | |
| 20-Feb-94 | 1,817,159 | 877 | 122 | |
| 21-Feb-94 | 2,209,501 | 3,056 | 120 | |
| 22-Feb-94 | 2,096,319 | 6,272 | 120 | |
| 23-Feb-94 | 1,371,821 | 1,431,166 | 121 | |
| 24-Feb-94 | 1,080,480 | 588,090 | 121 | |
| 25-Feb-94 | 1,006,867 | 609,921 | 119 | |
| 26-Feb-94 | 1,196,381 | 642,356 | 119 | |
| 27-Feb-94 | 1,850,507 | 4,934 | 120 | |
| 28-Feb-94 | 1,879,808 | 6,641 | 118 | |
| Monthly Total | 40,084,913 | 12,090,284 | 3,382 | 52,175,197 |
| 1-Mar-94 | 1,583,392 | 313,788 | 114 | |
| 2-Mar-94 | 1,509,592 | 290,443 | 115 | |
| 3-Mar-94 | 1,685,083 | 269,197 | 117 | |
| 4-Mar-94 | 1,829,905 | 0 | 117 | |
| 5-Mar-94 | 2,034,510 | 0 | 119 | |
| 6-Mar-94 | 1,999,218 | 0 | 118 | |
| 7-Mar-94 | 2,190,090 | 0 | 118 | |
| 8-Mar-94 | 1,600,971 | 351,450 | 119 | |
| 9-Mar-94 | 1,276,348 | 523,240 | 121 | |
| 10-Mar-94 | 1,147,523 | 787,973 | 120 | |
| 11-Mar-94 | 1,123,931 | 763,621 | 119 | |
| 12-Mar-94 | 967,995 | 952,193 | 124 | |
| 13-Mar-94 | 1,819,793 | 0 | 118 | |
| 14-Mar-94 | 2,232,189 | 0 | 119 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 15-Mar-94 | 1,091,510 | 767,646 | 117 | |
| 16-Mar-94 | 884,913 | 875,177 | 118 | |
| 17-Mar-94 | 1,059,781 | 791,021 | 118 | |
| 18-Mar-94 | 1,169,082 | 648,021 | 127 | |
| 19-Mar-94 | 1,228,166 | 1,133,340 | 126 | |
| 20-Mar-94 | 1,926,837 | 0 | 118 | |
| 21-Mar-94 | 2,175,121 | 4 | 120 | |
| 22-Mar-94 | 1,270,394 | 539,538 | 119 | |
| 23-Mar-94 | 1,239,694 | 580,385 | 121 | |
| 24-Mar-94 | 1,280,194 | 667,246 | 118 | |
| 25-Mar-94 | 1,280,016 | 689,818 | 117 | |
| 26-Mar-94 | 1,458,717 | 774,461 | 118 | |
| 27-Mar-94 | 2,306,883 | 75 | 116 | |
| 28-Mar-94 | 2,425,542 | 139 | 117 | |
| 29-Mar-94 | 1,366,629 | 958,768 | 119 | |
| 30-Mar-94 | 1,181,844 | 894,005 | 118 | |
| 31-Mar-94 | 981,991 | 1,131,325 | 117 | |
| Monthly Total | 47,327,854 | 14,702,874 | 3,682 | 62,030,728 |
| 1-Apr-94 | 981,964 | 1,084,672 | 119 | |
| 2-Apr-94 | 1,414,589 | 360,946 | 117 | |
| 3-Apr-94 | 1,934,133 | 65 | 116 | |
| 4-Apr-94 | 1,745,162 | 29 | 110 | |
| 5-Apr-94 | 1,173,951 | 509,063 | 118 | |
| 6-Apr-94 | 1,303,681 | 487,309 | 134 | |
| 7-Apr-94 | 1,185,539 | 415,419 | 119 | |
| 8-Apr-94 | 1,255,080 | 360,432 | 119 | |
| 9-Apr-94 | 1,333,867 | 375,629 | 117 | |
| 10-Apr-94 | 1,555,291 | 4,948 | 118 | |
| 11-Apr-94 | 1,821,965 | 3,037 | 116 | |
| 12-Apr-94 | 1,232,655 | 270,644 | 119 | |
| 13-Apr-94 | 1,061,466 | 498,299 | 116 | |
| 14-Apr-94 | 1,416,654 | 326,251 | 119 | |
| 15-Apr-94 | 1,441,993 | 325,286 | 119 | |
| 16-Apr-94 | 1,030,803 | 330,407 | 120 | |
| 17-Apr-94 | 1,419,993 | 693 | 129 | |
| 18-Apr-94 | 1,865,317 | 788 | 121 | |
| 19-Apr-94 | 851,659 | 624,749 | 128 | |
| 20-Apr-94 | 1,253,779 | 267,637 | 120 | |
| 21-Apr-94 | 1,256,318 | 276,535 | 119 | |
| 22-Apr-94 | 1,208,699 | 391,247 | 119 | |
| 23-Apr-94 | 1,199,323 | 329,504 | 119 | |
| 24-Apr-94 | 1,522,502 | 562 | 116 | |
| 25-Apr-94 | 1,657,181 | 595 | 116 | |
| 26-Apr-94 | 1,305,341 | 494,663 | 117 | |
| 27-Apr-94 | 1,335,865 | 320,862 | 113 | |
| 28-Apr-94 | 1,750,198 | 0 | 112 | |
| 29-Apr-94 | 1,315,368 | 285,868 | 116 | |
| 30-Apr-94 | 1,342,821 | 264,232 | 112 | |
| Monthly Total | 41,173,157 | 8,610,372 | 3,553 | 49,783,529 |
| 1-May-94 | 1,638,517 | 668 | 125 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 2-May-94 | 1,825,696 | 607 | 142 | |
| 3-May-94 | 1,582,168 | 204,077 | 146 | |
| 4-May-94 | 1,487,261 | 216,196 | 117 | |
| 5-May-94 | 1,478,119 | 309,487 | 111 | |
| 6-May-94 | 1,658,493 | 329,976 | 122 | |
| 7-May-94 | 1,435,267 | 262,930 | 121 | |
| 8-May-94 | 1,666,587 | 568 | 119 | |
| 9-May-94 | 1,970,494 | 496 | 117 | |
| 10-May-94 | 1,644,387 | 290,628 | 120 | |
| 11-May-94 | 1,642,485 | 344,258 | 118 | |
| 12-May-94 | 1,642,503 | 305,401 | 119 | |
| 13-May-94 | 1,403,069 | 1,037,006 | 119 | |
| 14-May-94 | 1,527,452 | 375,249 | 118 | |
| 15-May-94 | 1,721,278 | 631 | 113 | |
| 16-May-94 | 1,868,512 | 582 | 112 | |
| 17-May-94 | 1,147,013 | 410,036 | 111 | |
| 18-May-94 | 1,146,919 | 599,522 | 131 | |
| 19-May-94 | 899,597 | 622,820 | 109 | |
| 20-May-94 | 1,076,178 | 763,245 | 59 | |
| 21-May-94 | 1,176,219 | 707,506 | 63 | |
| 22-May-94 | 1,673,891 | 987 | 61 | |
| 23-May-94 | 2,100,436 | 973 | 61 | |
| 24-May-94 | 1,500,702 | 359,806 | 60 | |
| 25-May-94 | 1,353,482 | 1,123,865 | 60 | |
| 26-May-94 | 36,222 | 1,158,690 | 59 | |
| 27-May-94 | 55,824 | 1,111,077 | 60 | |
| 28-May-94 | 1,104,179 | 506,460 | 59 | |
| 29-May-94 | 1,615,858 | 1,016 | 58 | |
| 30-May-94 | 1,590,167 | 976 | 58 | |
| 31-May-94 | 2,070,307 | 972 | 56 | |
| Monthly Total | 44,739,281 | 11,046,712 | 3,004 | 55,785,993 |
| 1-Jun-94 | 900,734 | 821,190 | 56 | |
| 2-Jun-94 | 862,449 | 1,011,122 | 57 | |
| 3-Jun-94 | 1,329,329 | 402,181 | 56 | |
| 4-Jun-94 | 1,680,551 | 392,665 | 55 | |
| 5-Jun-94 | 1,898,137 | 971 | 56 | |
| 6-Jun-94 | 2,115,021 | 954 | 53 | |
| 7-Jun-94 | 1,537,767 | 633,919 | 52 | |
| 8-Jun-94 | 1,403,347 | 437,356 | 52 | |
| 9-Jun-94 | 1,350,745 | 691,867 | 53 | |
| 10-Jun-94 | 1,276,684 | 796,394 | 52 | |
| 11-Jun-94 | 1,276,557 | 833,052 | 52 | |
| 12-Jun-94 | 1,921,332 | 7,100 | 51 | |
| 13-Jun-94 | 2,453,926 | 1,021 | 51 | |
| 14-Jun-94 | 2,110,888 | 1,015,211 | 51 | |
| 15-Jun-94 | 969,965 | 1,393,459 | 49 | |
| 16-Jun-94 | 1,106,991 | 1,618,870 | 49 | |
| 17-Jun-94 | 1,068,952 | 1,329,674 | 53 | |
| 18-Jun-94 | 2,159,461 | 299,919 | 49 | |
| 19-Jun-94 | 2,723,219 | 976 | 50 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 20-Jun-94 | 2,764,855 | 880 | 49 | |
| 21-Jun-94 | 1,809,310 | 459,183 | 49 | |
| 22-Jun-94 | 800,565 | 1,298,625 | 48 | |
| 23-Jun-94 | 900,717 | 1,427,038 | 47 | |
| 24-Jun-94 | 900,622 | 1,707,236 | 46 | |
| 25-Jun-94 | 508,330 | 1,363,671 | 47 | |
| 26-Jun-94 | 1,824,023 | 1,031 | 46 | |
| 27-Jun-94 | 2,492,909 | 965 | 45 | |
| 28-Jun-94 | 406,938 | 1,407,385 | 45 | |
| 29-Jun-94 | 427,473 | 1,606,928 | 44 | |
| 30-Jun-94 | 1,350,598 | 900,469 | 44 | |
| Monthly Total | 44,332,395 | 21,861,312 | 1,507 | 66,193,707 |
| 1-Jul-94 | 1,109,230 | 931,486 | 44 | |
| 2-Jul-94 | 1,127,680 | 695,518 | 42 | |
| 3-Jul-94 | 1,868,036 | 961 | 43 | |
| 4-Jul-94 | 2,082,292 | 945 | 42 | |
| 5-Jul-94 | 2,224,502 | 939 | 42 | |
| 6-Jul-94 | 1,148,623 | 602,368 | 42 | |
| 7-Jul-94 | 1,184,193 | 1,018,384 | 41 | |
| 8-Jul-94 | 1,184,011 | 854,909 | 41 | |
| 9-Jul-94 | 1,226,798 | 1,070,102 | 40 | |
| 10-Jul-94 | 1,910,451 | 13,029 | 40 | |
| 11-Jul-94 | 1,991,609 | 973 | 39 | |
| 12-Jul-94 | 1,303,327 | 530,897 | 39 | |
| 13-Jul-94 | 1,303,122 | 646,238 | 39 | |
| 14-Jul-94 | 1,302,913 | 1,114,072 | 39 | |
| 15-Jul-94 | 1,061,979 | 1,008,646 | 38 | |
| 16-Jul-94 | 1,535,528 | 1,150,995 | 37 | |
| 17-Jul-94 | 1,757,585 | 26,756 | 37 | |
| 18-Jul-94 | 2,324,625 | 968 | 37 | |
| 19-Jul-94 | 1,275,819 | 899,691 | 36 | |
| 20-Jul-94 | 1,492,152 | 1,076,273 | 36 | |
| 21-Jul-94 | 1,204,159 | 1,578,757 | 36 | |
| 22-Jul-94 | 2,319,290 | 1,137,170 | 2 | |
| 23-Jul-94 | 1,525,741 | 1,019,869 | 41 | |
| 24-Jul-94 | 2,269,714 | 1,103 | 37 | |
| 25-Jul-94 | 2,692,431 | 993 | 36 | |
| 26-Jul-94 | 1,200,530 | 1,087,357 | 36 | |
| 27-Jul-94 | 381,790 | 2,340,549 | 36 | |
| 28-Jul-94 | 339,156 | 2,204,897 | 36 | |
| 29-Jul-94 | 325,387 | 2,106,359 | 67 | |
| 30-Jul-94 | 241,496 | 1,856,084 | 80 | |
| 31-Jul-94 | 1,930,194 | 13,451 | 79 | |
| Monthly Total | 44,844,363 | 24,990,738 | 1,280 | 69,835,101 |
| 1-Aug-94 | 2,691,352 | 1,097 | 74 | |
| 2-Aug-94 | 1,547,980 | 944,352 | 69 | |
| 3-Aug-94 | 1,488,503 | 956,769 | 66 | |
| 4-Aug-94 | 1,488,385 | 1,170,471 | 62 | |
| 5-Aug-94 | 1,332,210 | 1,066,585 | 60 | |
| 6-Aug-94 | 1,109,595 | 836,213 | 54 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 7-Aug-94 | 2,031,703 | 1,139 | 51 | |
| 8-Aug-94 | 2,350,215 | 1,027 | 48 | |
| 9-Aug-94 | 2,420,383 | 935 | 46 | |
| 10-Aug-94 | 2,247,736 | 963 | 44 | |
| 11-Aug-94 | 2,198,855 | 941 | 42 | |
| 12-Aug-94 | 2,176,119 | 927 | 42 | |
| 13-Aug-94 | 2,154,529 | 74 | 40 | |
| 14-Aug-94 | 1,897,670 | 0 | 38 | |
| 15-Aug-94 | 1,931,090 | 0 | 38 | |
| 16-Aug-94 | 1,880,374 | 0 | 37 | |
| 17-Aug-94 | 2,546,294 | 7,103 | 38 | |
| 18-Aug-94 | 2,465,520 | 51,843 | 65 | |
| 19-Aug-94 | 984,822 | 1,374,830 | 68 | |
| 20-Aug-94 | 582,815 | 1,453,057 | 56 | |
| 21-Aug-94 | 1,877,751 | 5,368 | 48 | |
| 22-Aug-94 | 1,860,447 | 54,603 | 44 | |
| 23-Aug-94 | 311,265 | 1,634,393 | 40 | |
| 24-Aug-94 | 365,908 | 1,355,100 | 36 | |
| 25-Aug-94 | 479,748 | 1,470,641 | 34 | |
| 26-Aug-94 | 520,803 | 1,251,730 | 34 | |
| 27-Aug-94 | 610,447 | 1,230,453 | 31 | |
| 28-Aug-94 | 1,604,268 | 202 | 29 | |
| 29-Aug-94 | 1,846,376 | 111 | 29 | |
| 30-Aug-94 | 750,440 | 975,120 | 29 | |
| 31-Aug-94 | 717,172 | 975,035 | 27 | |
| Monthly Total | 48,470,775 | 16,821,081 | 1,419 | 65,291,856 |
| 1-Sep-94 | 728,259 | 1,028,875 | 28 | |
| 2-Sep-94 | 1,471,370 | 436,757 | 27 | |
| 3-Sep-94 | 1,330,625 | 424,585 | 26 | |
| 4-Sep-94 | 1,775,671 | 342 | 25 | |
| 5-Sep-94 | 1,674,679 | 229 | 25 | |
| 6-Sep-94 | 2,142,172 | 0 | 24 | |
| 7-Sep-94 | 1,267,761 | 527,852 | 25 | |
| 8-Sep-94 | 1,267,378 | 561,737 | 24 | |
| 9-Sep-94 | 1,267,248 | 659,344 | 24 | |
| 10-Sep-94 | 91 | 580,052 | 24 | |
| 11-Sep-94 | 86 | 332 | 23 | |
| 12-Sep-94 | 2,128,400 | 0 | 24 | |
| 13-Sep-94 | 1,224,705 | 542,675 | 27 | |
| 14-Sep-94 | 1,224,386 | 548,097 | 23 | |
| 15-Sep-94 | 1,224,267 | 686,633 | 23 | |
| 16-Sep-94 | 1,223,965 | 579,170 | 23 | |
| 17-Sep-94 | 1,405,429 | 580,678 | 22 | |
| 18-Sep-94 | 1,733,403 | 263 | 23 | |
| 19-Sep-94 | 1,990,725 | 221 | 23 | |
| 20-Sep-94 | 1,224,832 | 575,959 | 22 | |
| 21-Sep-94 | 1,297,811 | 625,532 | 22 | |
| 22-Sep-94 | 1,342,535 | 440,679 | 22 | |
| 23-Sep-94 | 1,327,246 | 432,577 | 22 | |
| 24-Sep-94 | 376,105 | 838,183 | 22 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 25-Sep-94 | 730,995 | 910,006 | 22 | |
| 26-Sep-94 | 1,547,334 | 289 | 21 | |
| 27-Sep-94 | 951,563 | 468,083 | 21 | |
| 28-Sep-94 | 1,196,166 | 273,487 | 22 | |
| 29-Sep-94 | 944,994 | 300,291 | 21 | |
| 30-Sep-94 | 1,218,428 | 270,299 | 22 | |
| Monthly Total | 37,238,629 | 12,293,227 | 702 | 49,531,856 |
| 1-Oct-94 | 1,064,452 | 229,195 | 21 | |
| 2-Oct-94 | 1,447,080 | 418 | 22 | |
| 3-Oct-94 | 1,423,926 | 406 | 22 | |
| 4-Oct-94 | 1,104,054 | 265,405 | 21 | |
| 5-Oct-94 | 1,002,076 | 442,986 | 21 | |
| 6-Oct-94 | 987,177 | 432,566 | 21 | |
| 7-Oct-94 | 824,615 | 518,238 | 21 | |
| 8-Oct-94 | 396,293 | 984,726 | 21 | |
| 9-Oct-94 | 1,463,938 | 231 | 21 | |
| 10-Oct-94 | 1,424,623 | 186 | 21 | |
| 11-Oct-94 | 1,659,543 | 0 | 21 | |
| 12-Oct-94 | 1,212,094 | 277,225 | 21 | |
| 13-Oct-94 | 758 | 296,290 | 21 | |
| 14-Oct-94 | 1,244,996 | 302,614 | 21 | |
| 15-Oct-94 | 1,196,591 | 300,571 | 21 | |
| 16-Oct-94 | 1,596,122 | 7,386 | 21 | |
| 17-Oct-94 | 1,560,916 | 120 | 22 | |
| 18-Oct-94 | 1,240,882 | 298,868 | 23 | |
| 19-Oct-94 | 1,118,050 | 308,179 | 23 | |
| 20-Oct-94 | 999,440 | 291,799 | 24 | |
| 21-Oct-94 | 1,107,311 | 364,770 | 23 | |
| 22-Oct-94 | 1,171,094 | 325,272 | 25 | |
| 23-Oct-94 | 1,561,718 | 2,029 | 24 | |
| 24-Oct-94 | 1,559,412 | 1,399 | 24 | |
| 25-Oct-94 | 1,153,126 | 276,589 | 25 | |
| 26-Oct-94 | 1,322,567 | 301,879 | 24 | |
| 27-Oct-94 | 1,351,473 | 257,373 | 25 | |
| 28-Oct-94 | 1,412,768 | 297,902 | 25 | |
| 29-Oct-94 | 1,152,162 | 276,955 | 25 | |
| 30-Oct-94 | 1,445,511 | 232 | 25 | |
| 31-Oct-94 | 1,393,567 | 147 | 25 | |
| Monthly Total | 37,598,335 | 7,061,956 | 700 | 44,660,291 |
| 1-Nov-94 | 1,221,140 | 261,047 | 26 | |
| 2-Nov-94 | 1,025,563 | 240,045 | 26 | |
| 3-Nov-94 | 1,182,357 | 239,656 | 27 | |
| 4-Nov-94 | 935,220 | 312,973 | 26 | |
| 5-Nov-94 | 1,091,190 | 257,186 | 27 | |
| 6-Nov-94 | 1,083,960 | 172,432 | 27 | |
| 7-Nov-94 | 1,357,902 | 239 | 27 | |
| 8-Nov-94 | 1,091,276 | 264,846 | 28 | |
| 9-Nov-94 | 1,089,403 | 296,041 | 27 | |
| 10-Nov-94 | 1,079,368 | 272,489 | 28 | |
| 11-Nov-94 | 1,014,643 | 256,173 | 29 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|---------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 12-Nov-94 | 1,276,116 | 4,995 | 28 | |
| 13-Nov-94 | 1,455,250 | 256 | 29 | |
| 14-Nov-94 | 1,445,541 | 290 | 28 | |
| 15-Nov-94 | 703,412 | 413,096 | 29 | |
| 16-Nov-94 | 1,217,380 | 337,988 | 29 | |
| 17-Nov-94 | 902,269 | 487,220 | 30 | |
| 18-Nov-94 | 1,034,882 | 436,277 | 30 | |
| 19-Nov-94 | 1,041,559 | 404,792 | 31 | |
| 20-Nov-94 | 1,476,041 | 238 | 29 | |
| 21-Nov-94 | 1,478,707 | 248 | 30 | |
| 22-Nov-94 | 1,111,297 | 404,492 | 31 | |
| 23-Nov-94 | 1,225,778 | 272,168 | 31 | |
| 24-Nov-94 | 1,240,629 | 238,802 | 32 | |
| 25-Nov-94 | 1,301,096 | 23,749 | 31 | |
| 26-Nov-94 | 1,499,283 | 225 | 31 | |
| 27-Nov-94 | 1,476,639 | 230 | 32 | |
| 28-Nov-94 | 1,697,326 | 359 | 32 | |
| 29-Nov-94 | 1,087,210 | 350,937 | 33 | |
| 30-Nov-94 | 1,182,727 | 327,289 | 34 | |
| Monthly Total | 36,025,164 | 6,276,778 | 878 | 42,301,942 |
| 1-Dec-94 | 1,300,615 | 315,187 | 33 | |
| 2-Dec-94 | 1,033,280 | 307,578 | 35 | |
| 3-Dec-94 | 1,302,173 | 303,879 | 34 | |
| 4-Dec-94 | 1,393,387 | 332 | 35 | |
| 5-Dec-94 | 1,639,035 | 354 | 36 | |
| 6-Dec-94 | 1,327,159 | 286,893 | 36 | |
| 7-Dec-94 | 1,294,663 | 254,947 | 37 | |
| 8-Dec-94 | 1,304,857 | 294,578 | 38 | |
| 9-Dec-94 | 1,393,906 | 282,432 | 38 | |
| 10-Dec-94 | 1,281,283 | 277,814 | 38 | |
| 11-Dec-94 | 1,938,584 | 269,844 | 39 | |
| 12-Dec-94 | 1,593,271 | 291 | 38 | |
| 13-Dec-94 | 1,407,625 | 283,635 | 40 | |
| 14-Dec-94 | 1,800,074 | 381,514 | 40 | |
| 15-Dec-94 | 1,396,069 | 322,680 | 42 | |
| 16-Dec-94 | 1,269,808 | 308,443 | 41 | |
| 17-Dec-94 | 1,646,462 | 336,017 | 42 | |
| 18-Dec-94 | 2,109,441 | 457 | 42 | |
| 19-Dec-94 | 2,518,622 | 0 | 43 | |
| 20-Dec-94 | 1,500,683 | 402,530 | 44 | |
| 21-Dec-94 | 1,320,029 | 446,106 | 45 | |
| 22-Dec-94 | 1,915,356 | 172,109 | 45 | |
| 23-Dec-94 | 501,435 | 1,009,887 | 45 | |
| 24-Dec-94 | 1,614,027 | 344,291 | 46 | |
| 25-Dec-94 | 1,505,189 | 361 | 46 | |
| 26-Dec-94 | 1,587,845 | 416 | 46 | |
| 27-Dec-94 | 1,801,168 | 450 | 45 | |
| 28-Dec-94 | 1,373,830 | 253,467 | 47 | |
| 29-Dec-94 | 1,455,937 | 392,343 | 46 | |
| 30-Dec-94 | 1,130,711 | 489,635 | 47 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 31-Dec-94 | 1,177,920 | 399,807 | 49 | |
| Monthly Total | 45,834,444 | 8,138,277 | 1,278 | 53,972,721 |
| 1-Jan-95 | 1,772,948 | 424 | 48 | |
| 2-Jan-95 | 1,764,526 | 453 | 49 | |
| 3-Jan-95 | 2,002,521 | 40,872 | 49 | |
| 4-Jan-95 | 1,200,339 | 521,087 | 49 | |
| 5-Jan-95 | 1,250,846 | 646,292 | 50 | |
| 6-Jan-95 | 1,261,387 | 650,086 | 51 | |
| 7-Jan-95 | 1,422,702 | 655,451 | 52 | |
| 8-Jan-95 | 2,150,868 | 420 | 51 | |
| 9-Jan-95 | 2,246,592 | 464 | 52 | |
| 10-Jan-95 | 1,159,144 | 659,430 | 53 | |
| 11-Jan-95 | 1,111,582 | 783,234 | 52 | |
| 12-Jan-95 | 1,172,824 | 738,724 | 52 | |
| 13-Jan-95 | 1,224,624 | 771,663 | 54 | |
| 14-Jan-95 | 1,420,392 | 816,804 | 55 | |
| 15-Jan-95 | 2,279,677 | 497 | 55 | |
| 16-Jan-95 | 2,179,318 | 509 | 54 | |
| 17-Jan-95 | 2,300,132 | 492 | 54 | |
| 18-Jan-95 | 958,153 | 922,786 | 55 | |
| 19-Jan-95 | 850,453 | 968,345 | 55 | |
| 20-Jan-95 | 850,093 | 971,824 | 54 | |
| 21-Jan-95 | 953,313 | 994,647 | 55 | |
| 22-Jan-95 | 1,771,116 | 72,993 | 55 | |
| 23-Jan-95 | 2,053,151 | 0 | 56 | |
| 24-Jan-95 | 1,274,371 | 596,865 | 55 | |
| 25-Jan-95 | 1,315,044 | 582,435 | 55 | |
| 26-Jan-95 | 1,276,986 | 638,170 | 56 | |
| 27-Jan-95 | 1,110,194 | 757,125 | 57 | |
| 28-Jan-95 | 950,095 | 715,471 | 57 | |
| 29-Jan-95 | 1,837,304 | 574 | 57 | |
| 30-Jan-95 | 2,054,982 | 0 | 58 | |
| 31-Jan-95 | 1,549,169 | 455,525 | 57 | |
| Monthly Total | 46,724,846 | 13,963,662 | 1,662 | 60,688,508 |
| 1-Feb-95 | 1,519,296 | 437,132 | 58 | |
| 2-Feb-95 | 1,418,449 | 492,865 | 57 | |
| 3-Feb-95 | 1,500,645 | 335,873 | 58 | |
| 4-Feb-95 | 1,493,938 | 342,844 | 59 | |
| 5-Feb-95 | 1,783,395 | 522 | 58 | |
| 6-Feb-95 | 2,007,786 | 638 | 58 | |
| 7-Feb-95 | 1,253,666 | 622,428 | 60 | |
| 8-Feb-95 | 1,387,036 | 718,239 | 62 | |
| 9-Feb-95 | 1,387,086 | 690,759 | 77 | |
| 10-Feb-95 | 2,293,428 | 301,493 | 85 | |
| 11-Feb-95 | 1,871,030 | 676 | 85 | |
| 12-Feb-95 | 1,889,859 | 710 | 84 | |
| 13-Feb-95 | 1,862,598 | 753 | 84 | |
| 14-Feb-95 | 1,062,594 | 672,806 | 84 | |
| 15-Feb-95 | 697,716 | 1,013,785 | 84 | |
| 16-Feb-95 | 652,956 | 1,096,131 | 83 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 17-Feb-95 | 646,533 | 1,052,818 | 83 | |
| 18-Feb-95 | 1,202,311 | 474,672 | 83 | |
| 19-Feb-95 | 1,748,662 | 621 | 81 | |
| 20-Feb-95 | 1,745,936 | 673 | 80 | |
| 21-Feb-95 | 1,803,558 | 726 | 80 | |
| 22-Feb-95 | 1,130,169 | 533,701 | 81 | |
| 23-Feb-95 | 1,348,187 | 439,439 | 81 | |
| 24-Feb-95 | 1,362,461 | 352,723 | 80 | |
| 25-Feb-95 | 1,459,450 | 313,110 | 81 | |
| 26-Feb-95 | 1,603,500 | 678 | 80 | |
| 27-Feb-95 | 1,893,256 | 729 | 81 | |
| 28-Feb-95 | 1,414,318 | 434,080 | 81 | |
| Monthly Total | 41,439,819 | 10,331,624 | 2,108 | 51,771,443 |
| 1-Mar-95 | 1,213,457 | 433,518 | 81 | |
| 2-Mar-95 | 1,467,679 | 459,913 | 81 | |
| 3-Mar-95 | 1,282,171 | 426,679 | 80 | |
| 4-Mar-95 | 1,321,940 | 318,458 | 80 | |
| 5-Mar-95 | 1,753,267 | 687 | 80 | |
| 6-Mar-95 | 1,870,081 | 755 | 80 | |
| 7-Mar-95 | 1,322,882 | 342,252 | 80 | |
| 8-Mar-95 | 1,476,154 | 308,066 | 79 | |
| 9-Mar-95 | 1,310,105 | 262,448 | 78 | |
| 10-Mar-95 | 1,559,203 | 285,431 | 78 | |
| 11-Mar-95 | 1,584,602 | 264,532 | 77 | |
| 12-Mar-95 | 1,746,781 | 48,314 | 77 | |
| 13-Mar-95 | 2,093,080 | 744 | 77 | |
| 14-Mar-95 | 1,357,078 | 326,330 | 77 | |
| 15-Mar-95 | 1,357,278 | 426,678 | 75 | |
| 16-Mar-95 | 1,382,068 | 411,730 | 75 | |
| 17-Mar-95 | 1,422,006 | 599,934 | 75 | |
| 18-Mar-95 | 1,473,939 | 465,874 | 75 | |
| 19-Mar-95 | 1,943,828 | 692 | 75 | |
| 20-Mar-95 | 1,970,931 | 712 | 74 | |
| 21-Mar-95 | 1,328,205 | 298,408 | 74 | |
| 22-Mar-95 | 1,269,867 | 476,732 | 74 | |
| 23-Mar-95 | 1,269,276 | 540,764 | 74 | |
| 24-Mar-95 | 1,269,141 | 641,564 | 75 | |
| 25-Mar-95 | 1,113,898 | 741,241 | 74 | |
| 26-Mar-95 | 1,817,288 | 13,099 | 75 | |
| 27-Mar-95 | 1,980,798 | 677 | 73 | |
| 28-Mar-95 | 1,193,830 | 561,800 | 73 | |
| 29-Mar-95 | 1,404,900 | 424,820 | 73 | |
| 30-Mar-95 | 1,277,902 | 429,749 | 73 | |
| 31-Mar-95 | 1,248,206 | 438,915 | 72 | |
| Monthly Total | 46,081,841 | 9,951,516 | 2,364 | 56,033,357 |
| 1-Apr-95 | 1,357,740 | 348,789 | 71 | |
| 2-Apr-95 | 1,712,625 | 680 | 72 | |
| 3-Apr-95 | 2,032,573 | 706 | 67 | |
| 4-Apr-95 | 1,122,240 | 473,117 | 70 | |
| 5-Apr-95 | 1,428,411 | 340,399 | 68 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 6-Apr-95 | 1,384,623 | 319,549 | 70 | |
| 7-Apr-95 | 1,384,836 | 383,991 | 69 | |
| 8-Apr-95 | 1,308,419 | 525,496 | 68 | |
| 9-Apr-95 | 1,854,622 | 729 | 69 | |
| 10-Apr-95 | 1,954,377 | 1,070 | 68 | |
| 11-Apr-95 | 1,170,970 | 519,433 | 67 | |
| 12-Apr-95 | 1,291,541 | 446,030 | 65 | |
| 13-Apr-95 | 1,216,374 | 440,516 | 66 | |
| 14-Apr-95 | 1,305,332 | 386,446 | 63 | |
| 15-Apr-95 | 1,311,743 | 348,862 | 65 | |
| 16-Apr-95 | 1,736,256 | 740 | 62 | |
| 17-Apr-95 | 1,772,820 | 744 | 62 | |
| 18-Apr-95 | 1,197,815 | 473,572 | 64 | |
| 19-Apr-95 | 1,351,051 | 306,844 | 62 | |
| 20-Apr-95 | 1,324,981 | 476,312 | 61 | |
| 21-Apr-95 | 1,482,205 | 302,692 | 61 | |
| 22-Apr-95 | 1,274,893 | 294,149 | 60 | |
| 23-Apr-95 | 1,790,657 | 694 | 60 | |
| 24-Apr-95 | 2,018,317 | 706 | 59 | |
| 25-Apr-95 | 1,389,539 | 265,868 | 59 | |
| 26-Apr-95 | 1,542,858 | 271,748 | 59 | |
| 27-Apr-95 | 1,543,752 | 308,984 | 58 | |
| 28-Apr-95 | 1,541,755 | 335,975 | 57 | |
| 29-Apr-95 | 1,564,217 | 370,488 | 57 | |
| 30-Apr-95 | 1,869,239 | 3,312 | 56 | |
| Monthly Total | 45,236,781 | 7,948,643 | 1,915 | 53,185,424 |
| 1-May-95 | 2,131,318 | 644 | 56 | |
| 2-May-95 | 1,406,097 | 510,942 | 54 | |
| 3-May-95 | 1,077,143 | 653,043 | 54 | |
| 4-May-95 | 1,525,644 | 527,695 | 53 | |
| 5-May-95 | 1,486,508 | 468,790 | 53 | |
| 6-May-95 | 1,819,365 | 470,499 | 52 | |
| 7-May-95 | 2,243,763 | 758 | 52 | |
| 8-May-95 | 2,356,384 | 736 | 51 | |
| 9-May-95 | 1,383,597 | 614,233 | 51 | |
| 10-May-95 | 1,180,846 | 876,398 | 57 | |
| 11-May-95 | 1,241,460 | 770,826 | 54 | |
| 12-May-95 | 1,247,107 | 839,840 | 54 | |
| 13-May-95 | 1,091,719 | 1,122,459 | 54 | |
| 14-May-95 | 2,137,786 | 21,077 | 53 | |
| 15-May-95 | 1,973,338 | 31,779 | 53 | |
| 16-May-95 | 1,301,799 | 590,300 | 52 | |
| 17-May-95 | 1,247,209 | 754,694 | 52 | |
| 18-May-95 | 1,246,966 | 838,780 | 52 | |
| 19-May-95 | 1,246,544 | 1,027,092 | 50 | |
| 20-May-95 | 1,191,637 | 981,045 | 50 | |
| 21-May-95 | 1,964,122 | 31,591 | 49 | |
| 22-May-95 | 2,263,857 | 30,168 | 49 | |
| 23-May-95 | 1,260,666 | 560,950 | 46 | |
| 24-May-95 | 1,995,526 | 624,234 | 41 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 25-May-95 | 991,435 | 1,166,201 | 42 | |
| 26-May-95 | 923,107 | 1,133,751 | 42 | |
| 27-May-95 | 1,175,435 | 1,205,994 | 45 | |
| 28-May-95 | 2,136,015 | 778 | 40 | |
| 29-May-95 | 1,778,084 | 709 | 40 | |
| 30-May-95 | 1,998,862 | 0 | 40 | |
| 31-May-95 | 1,070,149 | 623,455 | 40 | |
| Monthly Total | 48,093,488 | 16,479,461 | 1,531 | 64,572,949 |
| 1-Jun-95 | 1,142,985 | 1,131,565 | 39 | |
| 2-Jun-95 | 1,300,498 | 956,789 | 39 | |
| 3-Jun-95 | 1,157,953 | 1,126,187 | 38 | |
| 4-Jun-95 | 1,594,775 | 32,516 | 38 | |
| 5-Jun-95 | 2,210,084 | 0 | 37 | |
| 6-Jun-95 | 1,295,935 | 990,229 | 37 | |
| 7-Jun-95 | 1,296,147 | 1,155,699 | 36 | |
| 8-Jun-95 | 1,402,308 | 1,493,968 | 37 | |
| 9-Jun-95 | 1,027,318 | 1,085,973 | 36 | |
| 10-Jun-95 | 1,272,162 | 981,708 | 35 | |
| 11-Jun-95 | 2,371,170 | 744 | 35 | |
| 12-Jun-95 | 2,568,335 | 698 | 35 | |
| 13-Jun-95 | 1,141,786 | 858,647 | 35 | |
| 14-Jun-95 | 1,183,539 | 1,244,034 | 33 | |
| 15-Jun-95 | 1,189,328 | 1,275,182 | 34 | |
| 16-Jun-95 | 1,096,498 | 1,534,496 | 33 | |
| 17-Jun-95 | 1,395,970 | 1,383,815 | 37 | |
| 18-Jun-95 | 2,485,942 | 375,614 | 32 | |
| 19-Jun-95 | 2,200,739 | 1,100,401 | 32 | |
| 20-Jun-95 | 1,951,509 | 1,250,620 | 32 | |
| 21-Jun-95 | 1,943,941 | 1,416,703 | 32 | |
| 22-Jun-95 | 1,396,955 | 1,837,023 | 31 | |
| 23-Jun-95 | 1,639,196 | 1,663,783 | 31 | |
| 24-Jun-95 | 1,733,234 | 1,490,030 | 30 | |
| 25-Jun-95 | 3,671,850 | 203 | 31 | |
| 26-Jun-95 | 3,328,160 | 110 | 30 | |
| 27-Jun-95 | 1,122,845 | 2,119,668 | 29 | |
| 28-Jun-95 | 1,092,170 | 2,338,113 | 29 | |
| 29-Jun-95 | 1,305,943 | 2,476,157 | 29 | |
| 30-Jun-95 | 1,446,833 | 2,397,985 | 23 | |
| Monthly Total | 49,966,108 | 33,718,660 | 1,005 | 83,684,768 |
| 1-Jul-95 | 3,092,220 | 521,269 | 35 | |
| 2-Jul-95 | 2,371,322 | 12,991 | 27 | |
| 3-Jul-95 | 2,298,085 | 24,490 | 28 | |
| 4-Jul-95 | 2,913,814 | 343 | 27 | |
| 5-Jul-95 | 3,000,000 | 191 | 26 | |
| 6-Jul-95 | 1,281,450 | 1,875,732 | 26 | |
| 7-Jul-95 | 984,516 | 2,242,960 | 26 | |
| 8-Jul-95 | 2,085,634 | 607,086 | 25 | |
| 9-Jul-95 | 1,979,373 | 287 | 25 | |
| 10-Jul-95 | 2,380,084 | 10,250 | 26 | |
| 11-Jul-95 | 2,625,163 | 748,889 | 25 | |

DATALOG #3: DAILY WATER USAGE (TELEMETRY SYSTEM DATA)

| Date | DANC Total Flow (gal) | WTP Total Flow (gal) | Fire Jockey Pump (cycles) | Monthly Water Totals (gal) |
|----------------------|--------------------------|-------------------------|------------------------------|-------------------------------|
| 12-Jul-95 | 753,721 | 2,242,060 | 25 | |
| 13-Jul-95 | 1,022,809 | 2,216,236 | 24 | |
| 14-Jul-95 | 1,105,196 | 2,224,593 | 25 | |
| 15-Jul-95 | 1,576,642 | 1,943,423 | 25 | |
| 16-Jul-95 | 5,336 | 25 | 0 | |
| 17-Jul-95 | 1,092,837 | 1,190,109 | 24 | |
| 18-Jul-95 | 864,373 | 1,442,092 | 24 | |
| 19-Jul-95 | 1,629,777 | 2,283,001 | 24 | |
| 20-Jul-95 | 632,125 | 1,843,820 | 24 | |
| 21-Jul-95 | 1,229,218 | 2,330,273 | 24 | |
| 22-Jul-95 | 357,263 | 1,763,536 | 24 | |
| 23-Jul-95 | 2,496,070 | 33,568 | 23 | |
| 24-Jul-95 | 2,191,405 | 286 | 23 | |
| 25-Jul-95 | 590,320 | 1,455,512 | 24 | |
| 26-Jul-95 | 445,968 | 1,841,972 | 23 | |
| 27-Jul-95 | 322,885 | 1,893,466 | 23 | |
| 28-Jul-95 | 249,575 | 1,678,010 | 25 | |
| 29-Jul-95 | 570,833 | 1,455,644 | 22 | |
| 30-Jul-95 | 2,006,231 | 20,750 | 23 | |
| 31-Jul-95 | 2,599,098 | 179 | 22 | |
| Monthly Total | 46,753,343 | 33,903,043 | 747 | 80,656,386 |
| 1-Aug-95 | 523,260 | 1,989,260 | 22 | |
| 2-Aug-95 | 289,266 | 1,908,941 | 22 | |
| 3-Aug-95 | 210,125 | 1,841,255 | 22 | |
| 4-Aug-95 | 205,716 | 1,791,515 | 22 | |
| 5-Aug-95 | 437,822 | 1,484,408 | 22 | |
| 6-Aug-95 | 1,952,053 | 390 | 21 | |
| 7-Aug-95 | 2,228,114 | 269 | 21 | |
| 8-Aug-95 | 1,580,288 | 597,177 | 22 | |
| 9-Aug-95 | 1,751,925 | 631,271 | 21 | |
| 10-Aug-95 | 1,286,937 | 1,732,253 | 21 | |
| 11-Aug-95 | 754,041 | 1,517,269 | 21 | |
| 12-Aug-95 | 932,990 | 1,273,900 | 23 | |
| 13-Aug-95 | 1,835,864 | 385 | 21 | |
| 14-Aug-95 | 2,337,220 | 235 | 21 | |
| 15-Aug-95 | 738,479 | 1,627,000 | 20 | |
| 16-Aug-95 | 627,647 | 2,261,300 | 22 | |
| 17-Aug-95 | 1,242,881 | 1,499,204 | 20 | |
| 18-Aug-95 | 1,204,298 | 1,587,841 | 0 | |
| 19-Aug-95 | 878,041 | 1,604,734 | 21 | |
| 20-Aug-95 | 3,000,000 | 341 | 20 | |
| 21-Aug-95 | 3,000,000 | 123 | 20 | |
| 22-Aug-95 | 1,329,171 | 1,443,045 | 19 | |
| 23-Aug-95 | 1,001,241 | 1,529,771 | 20 | |
| 24-Aug-95 | 1,412,082 | 1,634,597 | 20 | |
| 25-Aug-95 | 841,015 | 1,875,945 | 20 | |
| Monthly Total | 31,600,476 | 29,832,429 | 504 | 61,432,905 |

APPENDIX C
LEAK DETECTION SURVEY

Leak Detection Summary
1995 Leak Detection Report

LEAK DETECTION SURVEY - FT. DRUM, NY

| LEAK NO. | TYPE OF LEAK | LOCATION/ DESCRIPTION | SIZE (GPD) | PIPE/VALVE SIZE ADDITIONAL COMMENTS |
|----------|--------------|--|------------|--|
| 1-1 | Service Line | Building #9224 | 14,000 | |
| 1-2 | Fire Hydrant | Memorial Drive at South Entrance to Commissary | 1,000 | Leak noise quit when hydrant was tightened |
| 2-1 | Fire Hydrant | At Building #10270 | 1,000 | Leak noise quit when hydrant was tightened |
| 2-2 | Fire Hydrant | Fourth Street East | 1,000 | Leak noise quit when hydrant was tightened |
| 2-3 | Valve | Fourth Street East at 4th Armored Division | 2,000 | |
| 2-4 | Fire Hydrant | Fourth Street East at 4th Armored Division | 1,000 | Leak noise quit when hydrant was tightened |
| 2-5 | Fire Hydrant | Memorial Drive | 1,000 | Leak noise quit when hydrant was tightened |
| 2-6 | Valve | Fourth Street East at Lake Garda Lane | 5,000 | Leak noise quit when valve was tightened |
| 2-7 | Fire Hydrant | Building #10050 | 1,000 | Leak noise quit when hydrant was tightened |
| 2-8 | Fire Hydrant | Riva Ridge, North Loop | 1,000 | Leak noise quit when hydrant was tightened |
| 2-9 | Fire Hydrant | Memorial Drive at 45th Infantry Division Drive | 1,000 | Leak noise quit when hydrant was tightened |
| 2-10 | Fire Hydrant | Motor Pool Building #10173 | 1,000 | Leak noise quit when hydrant was tightened |
| 2-11 | Fire Hydrant | Memorial Drive at 2nd Street | 1,000 | Leak noise quit when hydrant was tightened |
| 3-1 | Fire Hydrant | Building #4325 | 1,000 | Leak noise quit when hydrant was tightened |
| 3-2 | Fire Hydrant | Building #4485 | 1,000 | Leak noise quit when hydrant was tightened |
| 4-1 | Fire Hydrant | Rail Road Street at Oswego Avenue | 1,000 | |
| 4-2 | Fire Hydrant | Rail Road Street at Lewis Avenue | 1,000 | |
| 4-3 | Fire Hydrant | Building #T-145 | 1,000 | |
| 4-4 | Fire Hydrant | First Street East at Nash Blvd. | 1,000 | |
| 4-5 | Fire Hydrant | Second Street at St. Lawrence Avenue | 1,000 | |
| 4-6 | Fire Hydrant | Second Street at Lewis Avenue | 1,000 | |
| 4-7 | Fire Hydrant | Pine Lane, Building #T-2256 | 1,000 | |
| 5-1 | Fire Hydrant | George Street at Cannon Avenue | 1,000 | |
| 5-2 | Fire Hydrant | Cannon Avenue at Delahanty Street | 1,000 | |
| 5-3 | Service Line | Building #T-2315 | 15,000 | 1-1/2" service line |
| 5-4 | Fire Hydrant | Lewis Avenue, Building #T-1050 | 1,000 | |
| 5-5 | Fire Hydrant | Nash Blvd., Building #T-1004 | 1,000 | |
| 5-6 | Main Line | Hospital Area, Building #T-2473 | 125,000 | 12" main line connected to old 2" service |
| 5-7 | Fire Hydrant | Coyler Drive at Dunn Avenue | 1,000 | |
| 6-1 | Fire Hydrant | Airport Access Road, across from Bldg. #2074 | 1,000 | |
| 7-1 | Fire Hydrant | Building #8527 | 1,000 | Leak noise quit when hydrant was tightened |

LEAK SUMMARY

| Leak Type | No. of Leaks | Size (GPD) | Size (KGal/Yr) |
|-----------------|--------------|------------|----------------|
| Main Line | 1 | 125,000 | 45,625 |
| Service Line | 2 | 29,000 | 10,585 |
| Valve | 1 | 2,000 | 730 |
| Valve (Fixed) | 1 | 5,000 | 1,825 |
| Fire Hydrant | 13 | 13,000 | 4,745 |
| Hydrant (Fixed) | 13 | 13,000 | 4,745 |
| Total Leakage | 17 | 169,000 | 61,685 |
| Leakage (Fixed) | 14 | 18,000 | 6,570 |
| Total | 31 | 187,000 | 68,255 |

^{M.E.} **SIMPSON** Co., Inc.

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Valparaiso, IN 46384

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Branch office:
Grayslake, IL

November 20, 1995

Mr. Michael Scholz, P.E.
Project Manager
EMC Engineers, Inc.
2750 S. Wadsworth Blvd., Suite C-200
Denver, CO 80227

Dear Mr. Scholz,

M.E. Simpson Company is a professional & technical service company that offers Leak Survey Programs, Large Meter Testing and Repair Programs, Water Main Location, and Valve Exercising, Location and Computer Mapping Programs. These "**Professional Services**" offered by M. E. Simpson Company are designed to aid a utility in reducing unaccounted for water and recovering lost revenue.

M. E. Simpson Company is pleased to submit this report of our leak detection survey for the Fort Drum Military Reservation. This survey addressed the Ft. Drum water distribution system, consisting of approximately 129 miles of water main. The report contains the results of our investigation that includes the following:

1. A LISTING OF THE MEETINGS HELD WITH FT. DRUM PERSONNEL
2. A DESCRIPTION OF THE AREA SURVEYED.
3. METHODOLOGY OF THE SURVEY
4. A LIST OF LEAKS AND TYPE OF LEAK LOCATED.
5. GENERAL RECOMMENDATIONS BASED ON OUR INVESTIGATION.

LISTING OF THE MEETINGS HELD WITH FORT DRUM PERSONNEL

M.E. Simpson Company personnel held numerous meetings with Ft. Drum personnel to keep them updated on the progress of the leak survey. The following is a listing of the meetings, who was there, and what was discussed:

10/24/95 - Project briefing - Michael Scholz, EMC
Greg Engel, M.E. Simpson Company
George Engel, M.E. Simpson Company
Michael Simpson, M.E. Simpson Company
Steve Rowley, Public Works-Ft. Drum
Joe Ogiba, Public Works-Ft. Drum
Bill Center, EMC
Tom Poeling, EMC

10/24/95 - project briefing of leak survey - John Kerr, M. Simpson, G. Engel, G. Engel.

10/25/95 - project briefing of area we were working in - J. Kerr, G. Engel, G. Engel.

10/26/95 - project briefing of area we were working in - J. Kerr, G. Engel, G. Engel.

10/27/95 - project briefing of area we were working in - J. Kerr, G. Engel, G. Engel.

10/30/95 - project briefing of area we were working in - J. Kerr, G. Engel, G. Engel.

10/31/95 - project briefing of area we were working in and to introduce John & Ray - Frank, J. Kerr
G. Engel, J. Van Arsdel, G. Engel, Ray Jones.

11/01/95 - project briefing of area we were working in & listen to the well field - J. Kerr, G. Engel,
J. Van Arsdel, R. Jones, G. Engel.

11/02/95 - project briefing of area we were working in - J. Kerr, J. Van Arsdel, R. Jones.

11/03/95 - project briefing of area we were working in - J. Kerr, J. Van Arsdel, R. Jones.

11/06/95 - project briefing of area we were working in and a correlator & related equipment demo -
J. Ogiba, J. Kerr, J. Van Arsdel, R. Jones.

11/07/95 - project briefing, gave complete update and overview of everything that was surveyed and leaks
found. Answered questions pertaining to the project. - Steve Rowley, Frank, John Van Arsdel
R. Jones, J. Ogiba, J. Kerr.

DESCRIPTION OF THE AREA SURVEYED

Approximately 681.120 lineal feet was surveyed as part of the system investigation. This included all fire hydrants, all accessible mainline valves, and 30 services.

METHODOLOGY

M.E. Simpson Company used the **FLUID CONSERVATION SYSTEMS S20** listening device along with the **MP90** preamplifier-transducer system to conduct your survey. Our experienced technicians used these devices as listening equipment to survey the pipeline network. Each hydrant, and accessible valves were used as listening points to identify leaks. Service, b-boxes, (30) were used to keep the listening distances under four hundred fifty feet (450'). "**Pin-Pointing**" of the leak, as well as locating leaks that other methods failed to reveal was done with the **90/90** and or **C2000 LEAK CORRELATORS**, the latest state of the art leak computers. These electronic instruments are microprocessor units that measure the time it takes the sound of the leak to travel from the leak to the point where the leak correlator is connected to the water line. By connecting the leak correlator to the water line at two locations, it will compute the distance from the leak to each connection point thus enabling us to determine the exact leak location. The results of the leak survey, including an estimate of water loss for the leaks identified, is documented in this report.

LEAKAGE LOCATED

All water mains within the project area were surveyed and thirty one leaks were located. There was one main line leaks, two service line leak, two valve leaks, and the balance fire hydrant leaks. All of these leaks have been verbally reported to your office with their location, so many have probably been repaired already. Following are the leak locations with an estimated GPD (Gallons Per Day) leakage potential:

| TYPE | LOCATION | SIZE |
|----------|---|------------|
| Sec. - 1 | | |
| Service | Building #9224 (Leak # 1-1) see enclosed diagram | 14,000 GPD |

| TYPE | LOCATION | SIZE |
|-----------------|---|-----------|
| Sec. - 1 | | |
| Fire Hydrant | Memorial Drive at the South entrance to the Commissary (Leak # 1-2) see enclosed diagram **fixed** | 1,000 GPD |
| Sec. - 2 | | |
| Fire Hydrant | at Building #10270 (Leak # 2-1) see enclosed diagram **fixed** | 1,000 GPD |
| Fire Hydrant | Forth Street East (Leak # 2-2) see enclosed diagram **fixed** | 1,000 GPD |
| Valve | Forth Street East at 4th Armored Division (Leak # 2-3) see enclosed diagram | 2,000 GPD |
| Fire Hydrant | Forth Street East at 4th Armored Division (Leak # 2-4) see enclosed diagram **fixed** | 1,000 GPD |
| Fire Hydrant | Memorial Drive (Leak # 2-5) see enclosed diagram **fixed** | 1,000 GPD |
| Valve | Forth Street East at Lake Garda Lane (Leak # 2-6) see enclosed diagram **fixed** | 5,000 GPD |
| Fire Hydrant | Building #10050 (Leak # 2-7) see enclosed diagram **fixed** | 1,000 GPD |
| Fire Hydrant | Riva Ridge, North loop (Leak # 2-8) see enclosed diagram **fixed** | 1,000 GPD |
| Fire Hydrant | Memorial Drive at 45th Infantry Div. Dr. (Leak # 2-9) see enclosed diagram **fixed** | 1,000 GPD |
| Fire Hydrant | Motor Pool, Building #10173 (Leak # 2-10) see enclosed diagram **fixed** | 1,000 GPD |
| Fire Hydrant | Memorial Drive at 2nd Street (Leak # 2-11) see enclosed diagram **fixed** | 1,000 GPD |
| Sec. - 3 | | |
| Fire Hydrant | Building # 4325 (Leak # 3-1) see enclosed diagram **fixed** | 1,000 GPD |
| Fire Hydrant | Building # 4485 (Leak # 3-2) see enclosed diagram **fixed** | 1,000 GPD |
| Sec. - 4 | | |
| Fire Hydrant | Rail Road Street at Oswego Avenue (Leak # 4-1) see enclosed diagram | 1,000 GPD |
| Fire Hydrant | Rail Road Street at Lewis Avenue (Leak # 4-2) see enclosed diagram | 1,000 GPD |

| TYPE | LOCATION | SIZE |
|--------------------------------|--|--------------------|
| Sec. - 4 | | |
| Fire Hydrant | Building # T-145 (Leak # 4-3) see enclosed diagram | 1,000 GPD |
| Fire Hydrant | First Street East at Nash Blvd. (Leak # 4-4) see enclosed diagram | 1,000 GPD |
| Fire Hydrant | Second Street at St. Lawrence Avenue (Leak # 4-5) see enclosed diagram | 1,000 GPD |
| Fire Hydrant | Second Street at Lewis Avenue (Leak # 4-6) see enclosed diagram | 1,000 GPD |
| Fire Hydrant | Pine Lane, Building # T-2256 (Leak # 4-7) see enclosed diagram | 1,000 GPD |
| Sec. - 5 | | |
| Fire Hydrant | George Street at Cannon Avenue (Leak # 5-1) see enclosed diagram | 1,000 GPD |
| Fire Hydrant | Cannon Avenue at Delahanty Street (Leak # 5-2) see enclosed diagram (visible) | 1,000 GPD |
| Service Line | Building # T-2315 (Leak # 5-3) see enclosed diagram (visible) | 15,000 GPD |
| Fire Hydrant | Lewis Avenue, Building # T-1050 (Leak # 5-4) see enclosed diagram | 1,000 GPD |
| Fire Hydrant | Nash Blvd., Building # T-1004 (Leak # 5-5) see enclosed diagram | 1,000 GPD |
| Main Line | Hospital Area, Building # T-2473 (Leak # 5-6) see enclosed diagram | 125,000 GPD |
| Fire Hydrant | Coyler Drive at Dunn Avenue (Leak # 5-7) see enclosed diagram | 1,000 GPD |
| Sec. - 6 | | |
| Fire Hydrant | Airport Access Road, across from Building # 2074 (Leak # 6-1) see enclosed diagram | 1,000 GPD |
| Sec. - 7 | | |
| Fire Hydrant | Building # 8527 (Leak # 7-1) see enclosed diagram **fixed** | 1,000 GPD |
| ESTIMATED LEAKAGE TOTAL | | 187,000 GPD |

LEAK QUANTITIES

Quantifying leaks is difficult because there is not any accurate means of doing so. Pipe material, size of the leak, system pressure, soil material and water table will effect the noise that a leak makes. Small leaks under high system pressure will make more noise than a large leak under low system pressure. However, the above leaks are of sufficient noise levels that the above estimates should be very conservative. Using a purchase price of \$5.73 per thousand gallons, these leaks were costing your utility in excess of \$1,071.00 per day or \$390,915.00 annually. It obvious that this Leak Survey Program has proven to be very cost effective. Naturally the main line leaks have the greatest potential for loss followed by service line, valves, and finally hydrants. Once leaks have been repaired, we would recommend that the Utility compare pumping rates before and after. This information will be more meaningful and accurate.


Please note that the per thousand cost used is what DANC is currently charging for water. If you use an estimated cost, the cost of purchasing the water in April 1997, the per day costs drops to \$267.00 or an annual rate of \$97,455.00. Also you need to consider the cost of running your wells in this equation.

RECOMMENDATIONS

This survey confirms that Ft. Drum's water distribution system will benefit from this project by a reduction in underground leakage. There is always a concern over the cost effectiveness of leak detection because of the uncertainty of the number of leaks located. However, with your present cost of water and the discovery of these thirty one leaks, the cost of this 1995 leak survey will pay for itself within two month. It only takes a recovery of about 56,000 gallons per day on an annual basis (56,000 gallons per day is only 38.8 gallons per minute throughout your entire water distribution system) to recover your investment. We would recommend that you conduct a Leak Survey Program every year. This recommendation becomes more critical as your cost of water increases.

We appreciate the cooperation of Mr. Ogiba, Mr. Kerr and their staff who were available to answer our questions during this project. If you have any questions with the information in this report, please do not hesitate to call.

Sincerely Yours,



Michael D. Simpson
Operations Manager

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

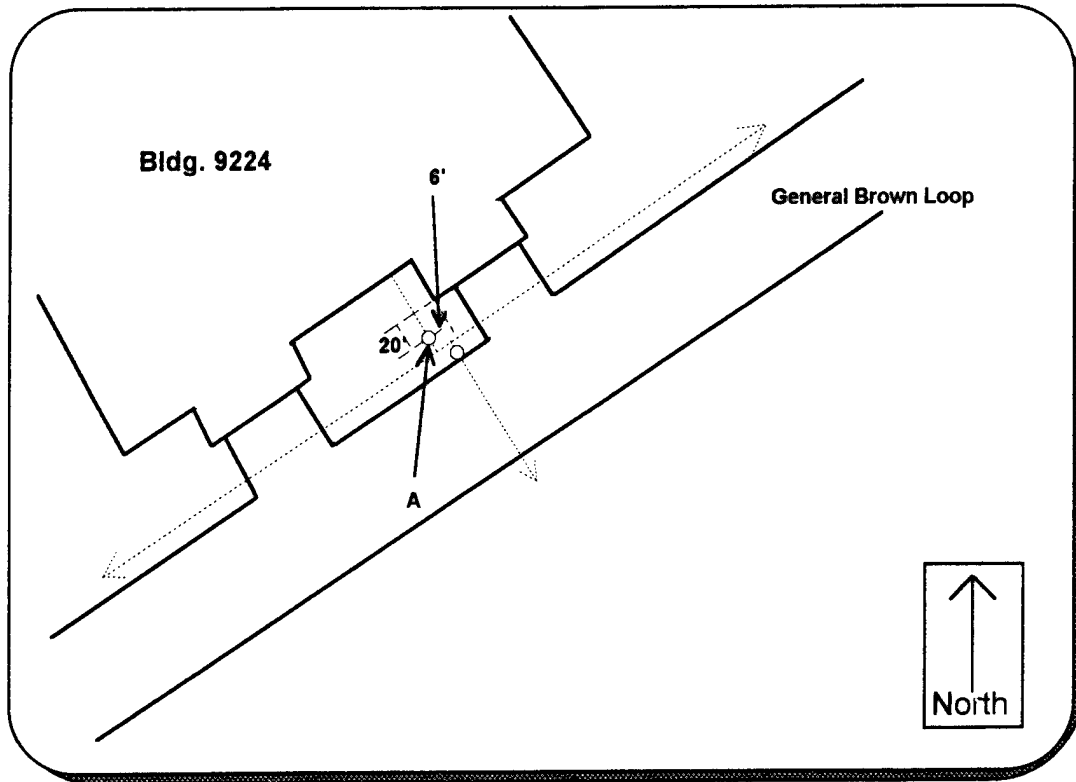
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 1-1

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments Service leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

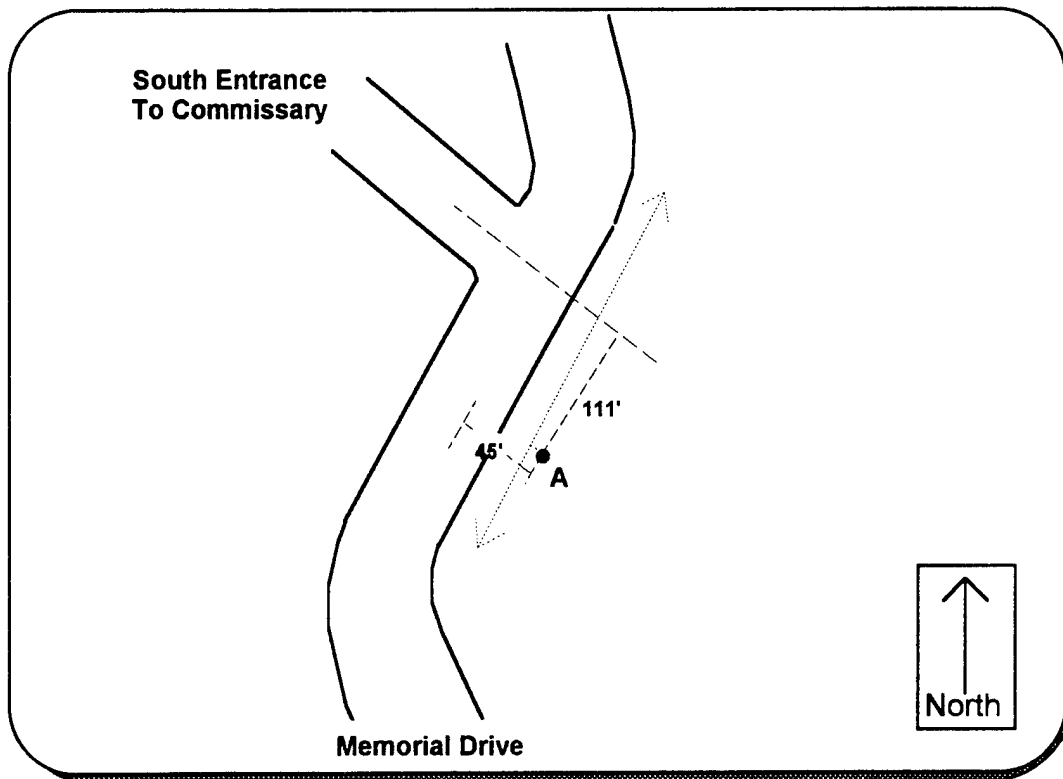
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, November 02, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 1-2

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

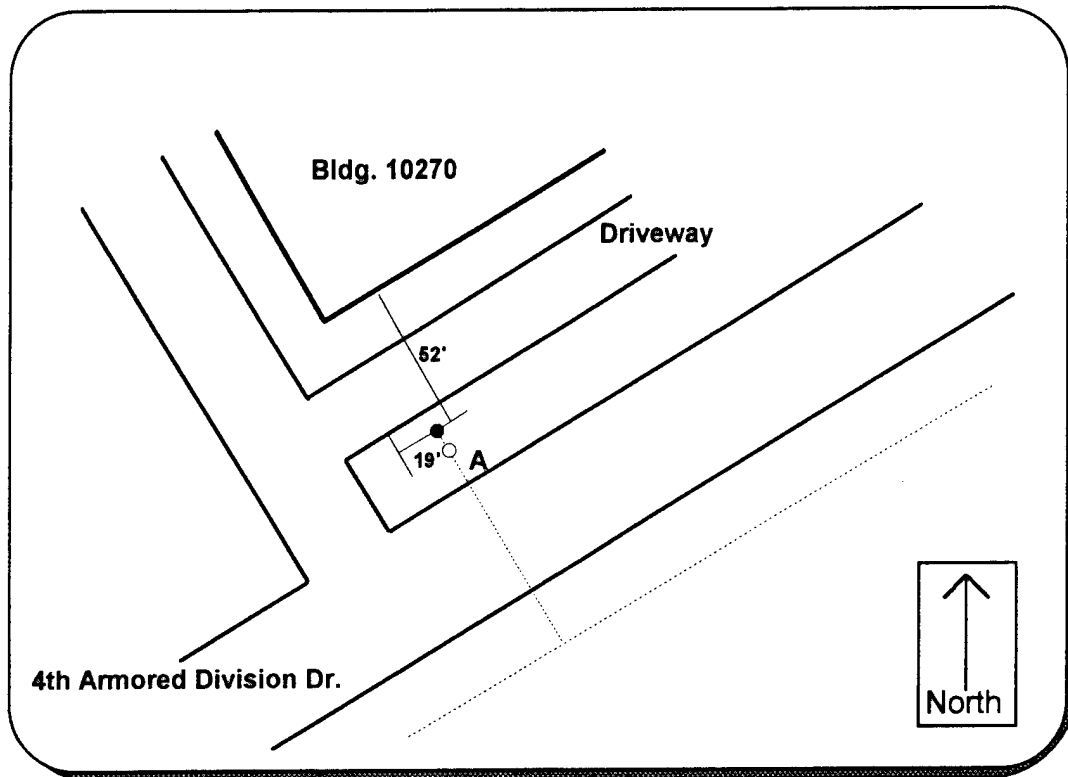
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, November 02, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-1

Distance: 0' From A

Connection point: A= Hydrant.

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

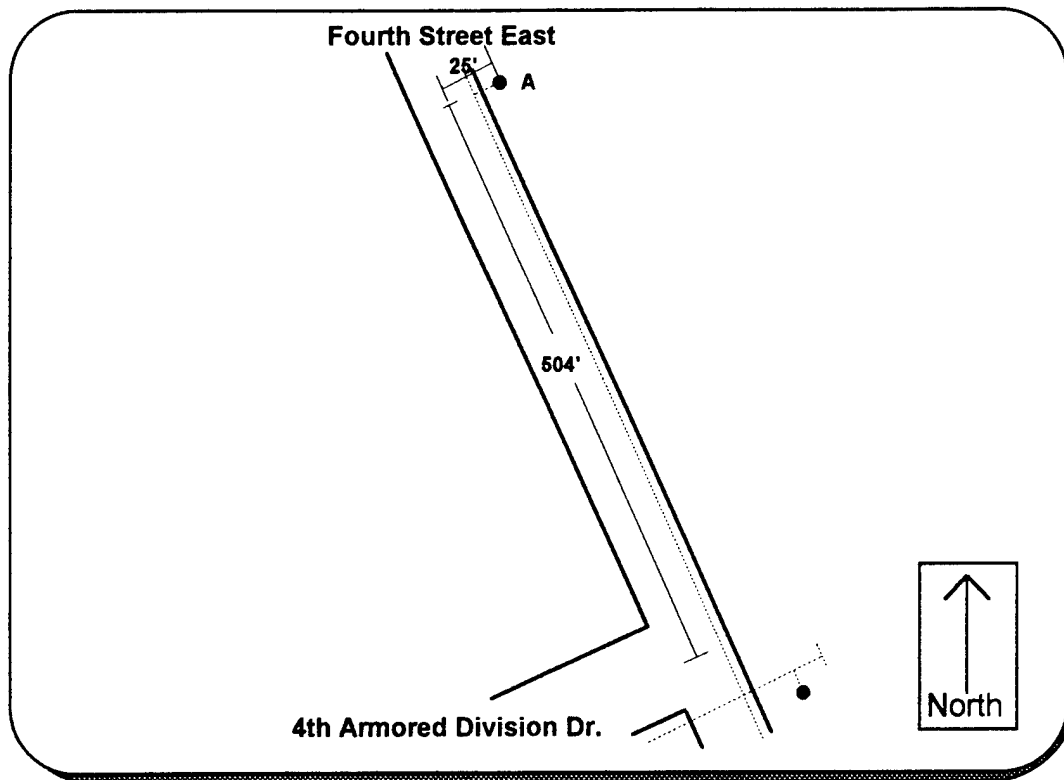
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-2

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

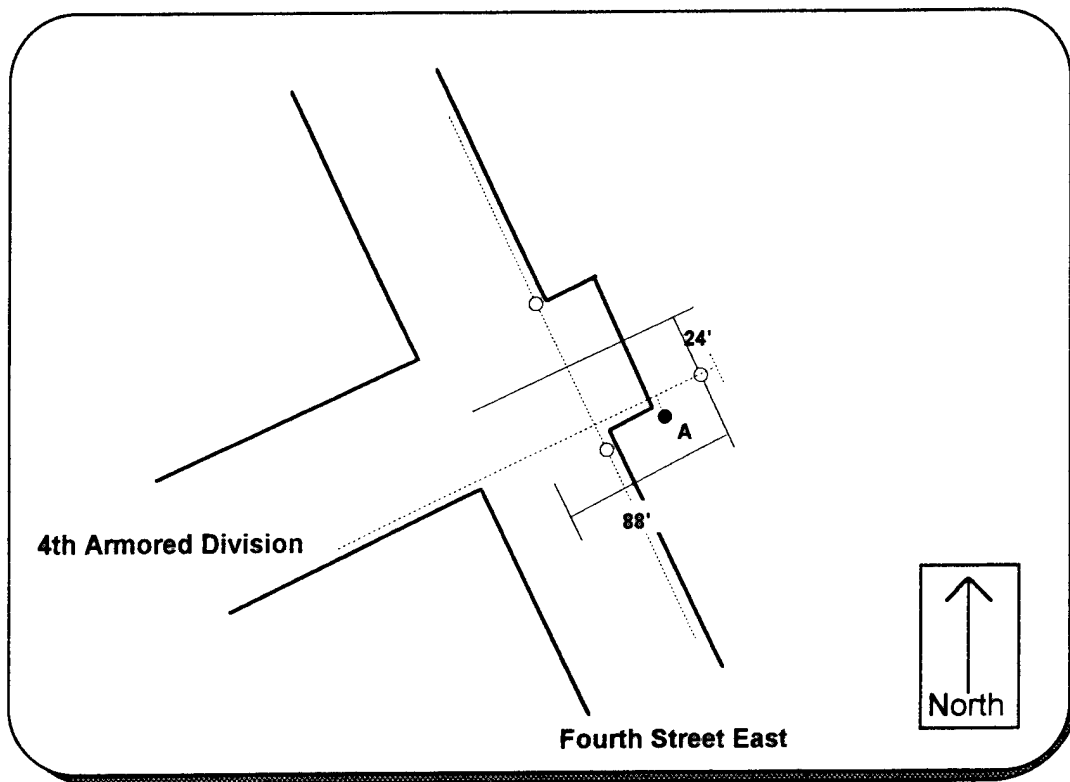
Client: Fort Drum, New York

Time: Leak Survey

Date: Tuesday, November 07, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-3

Distance: 0' From A

Connection point: A= Stub valve.

Connection point:

Leak Location: 0' From A

Comments This stub valve is leaking through in closed position. Box is off to one side.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

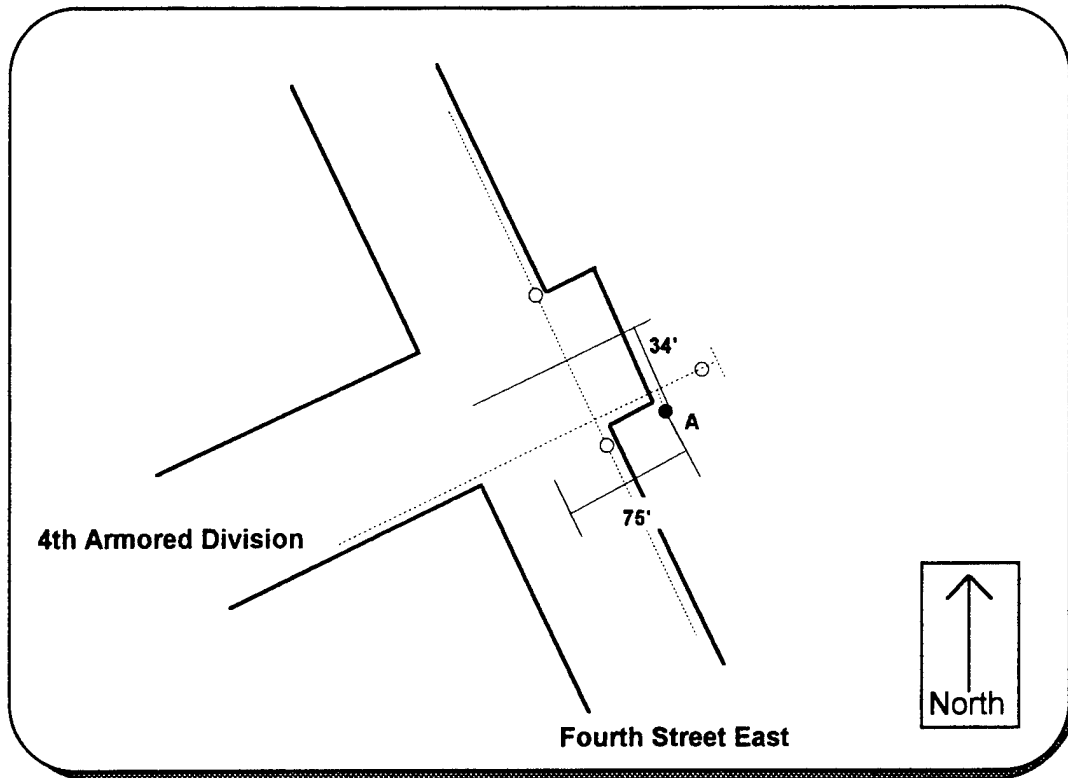
Client: Fort Drum, New York

Time: Leak Survey

Date: Tuesday, November 07, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-4

Distance: 0' From A

Connection point: A= Hydrant.

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

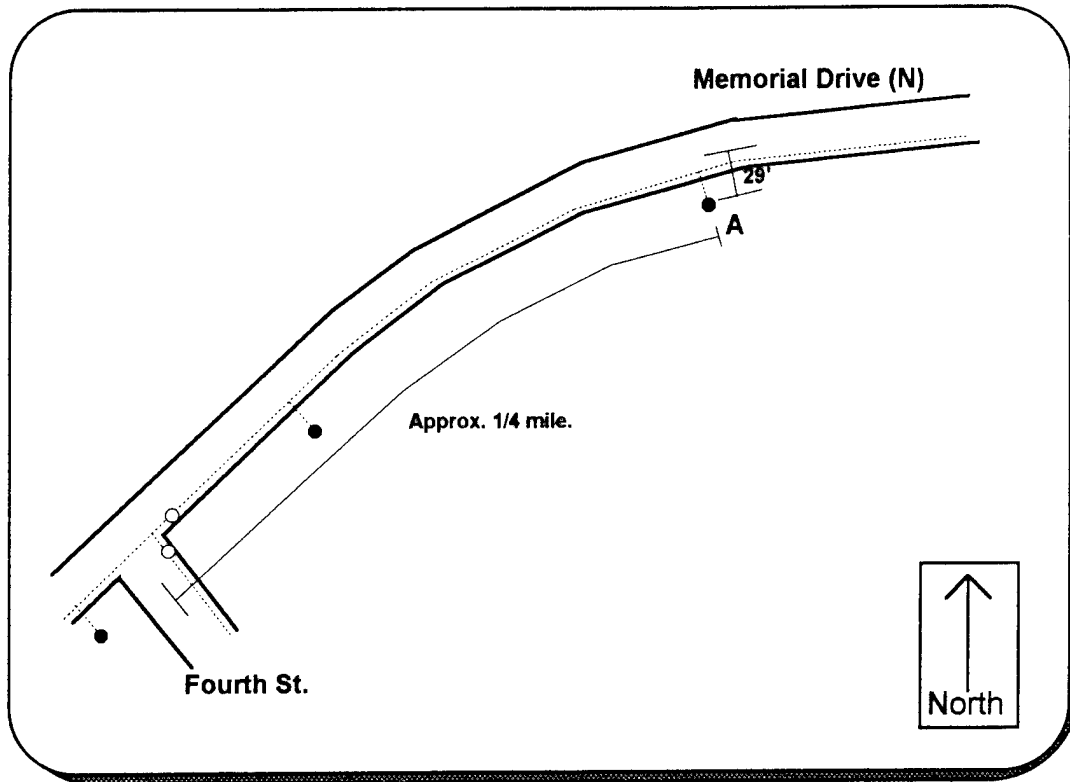
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-5

Distance: 0' From A

Connection point: A= Hydrant.

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

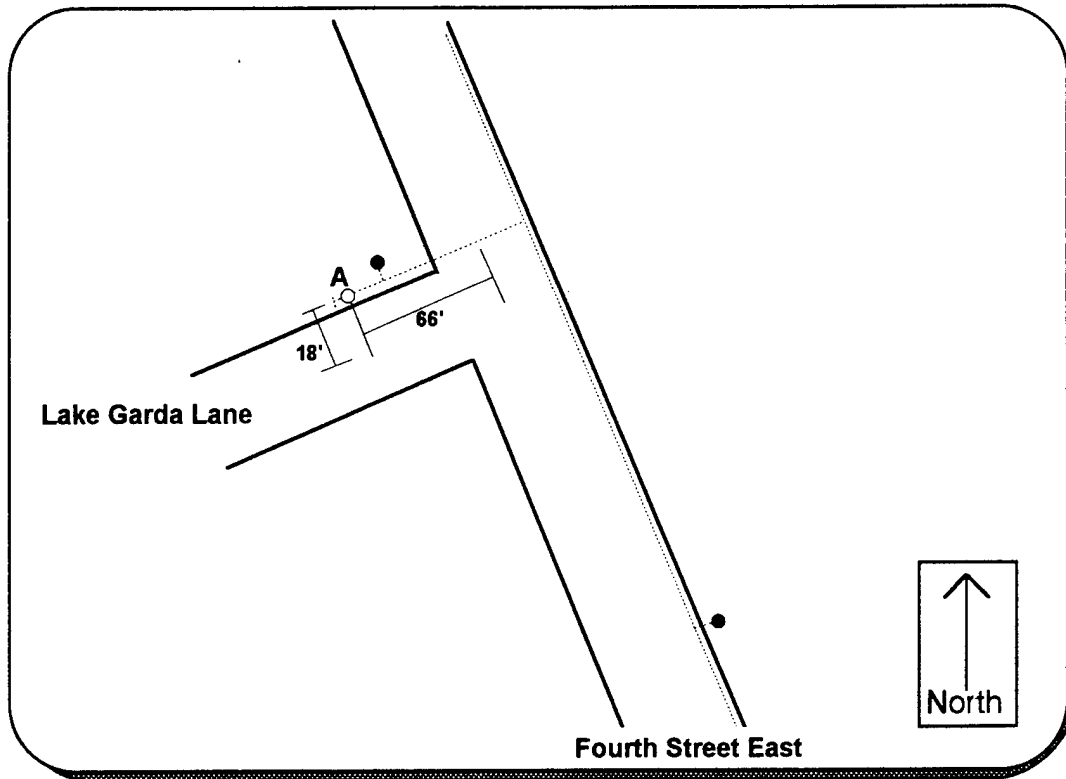
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-6

Distance: 0' From A

Connection point: A= Stub valve.

Connection point:

Leak Location: 0' From A

Comments This stub valve was found 1 1/2 turns open. Leak noise quit when we closed the valve fully.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

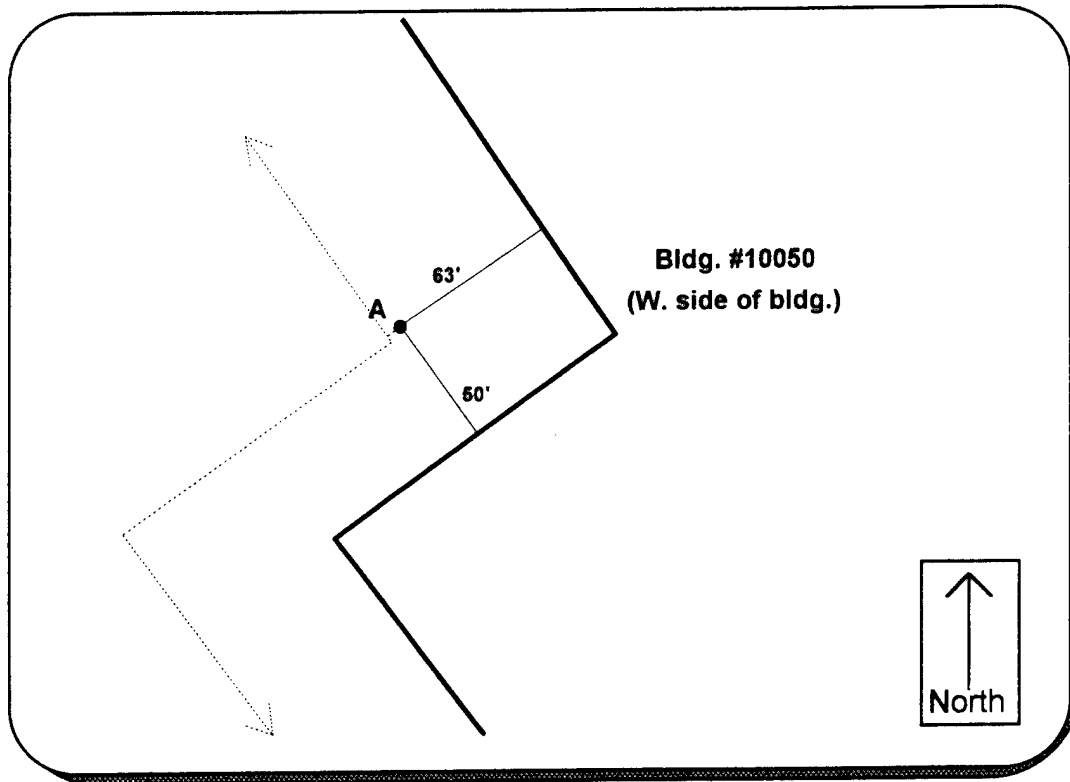
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-7

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

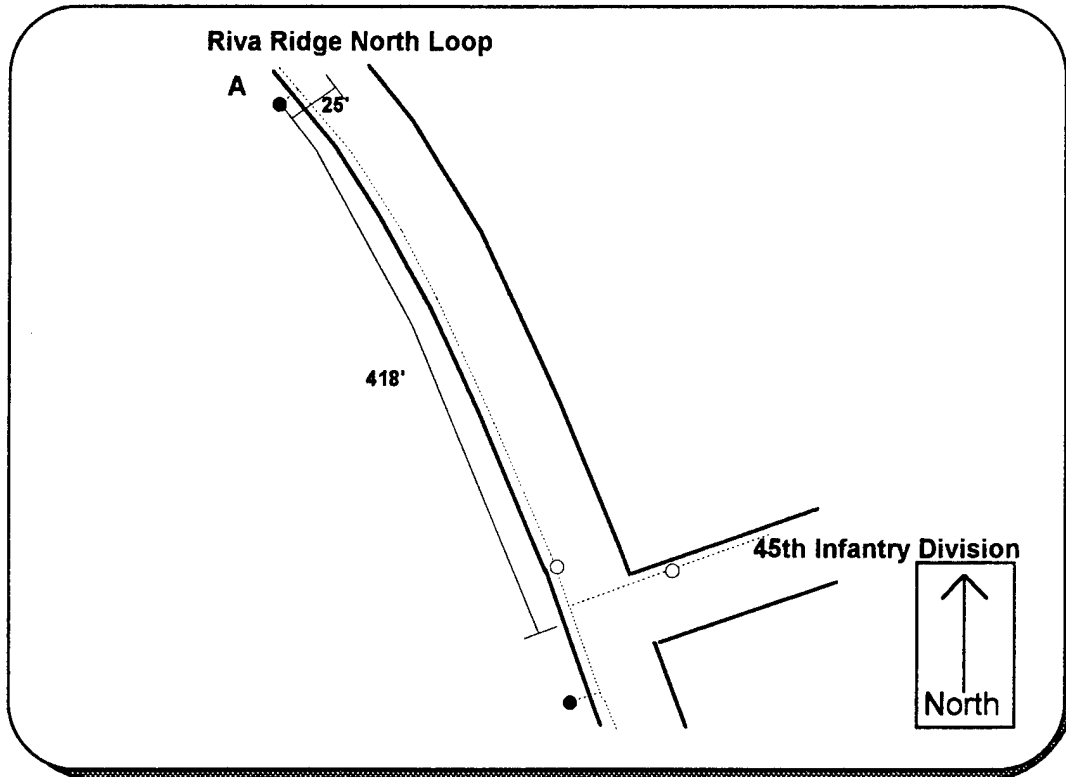
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-8

Distance: 0' From A

Connection point: A= Hydrant.

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

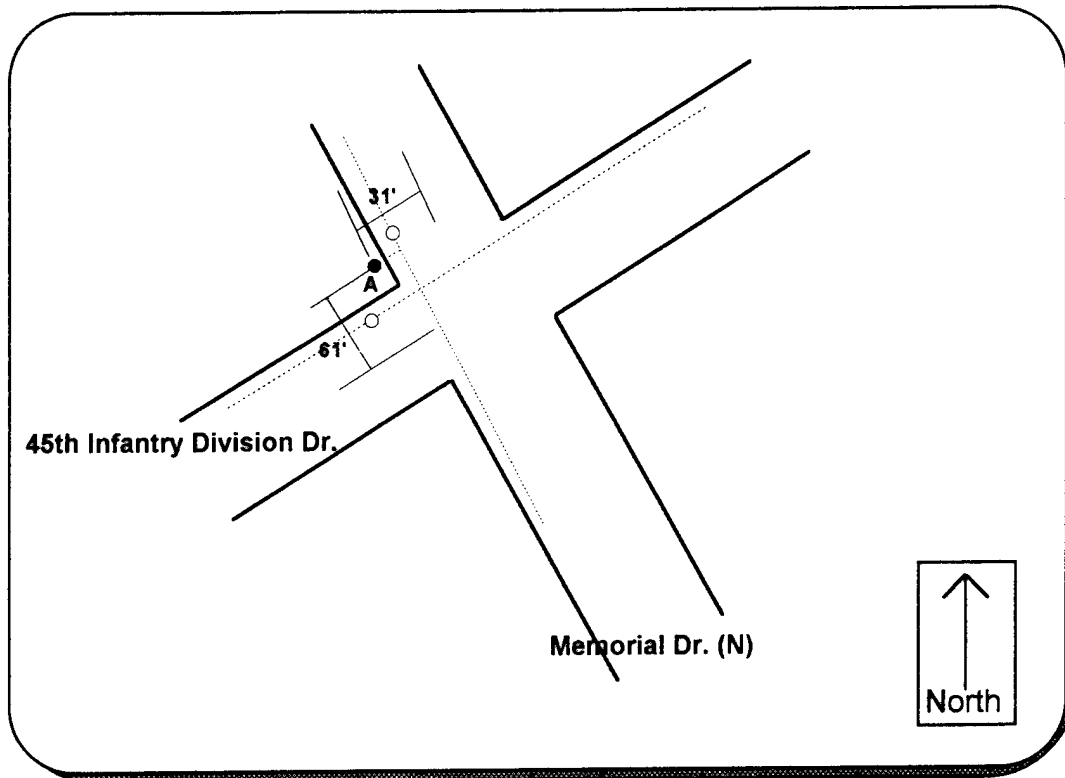
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-9

Distance: 0' From A

Connection point: A= Hydrant.

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

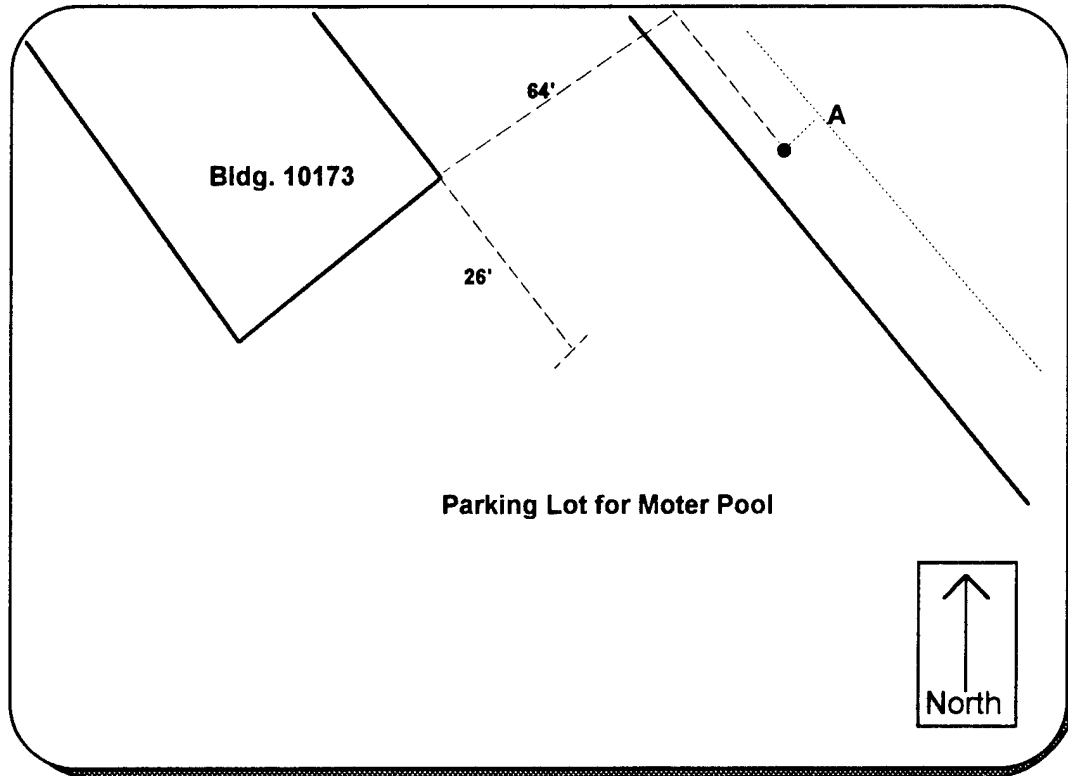
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, November 02, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-10

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

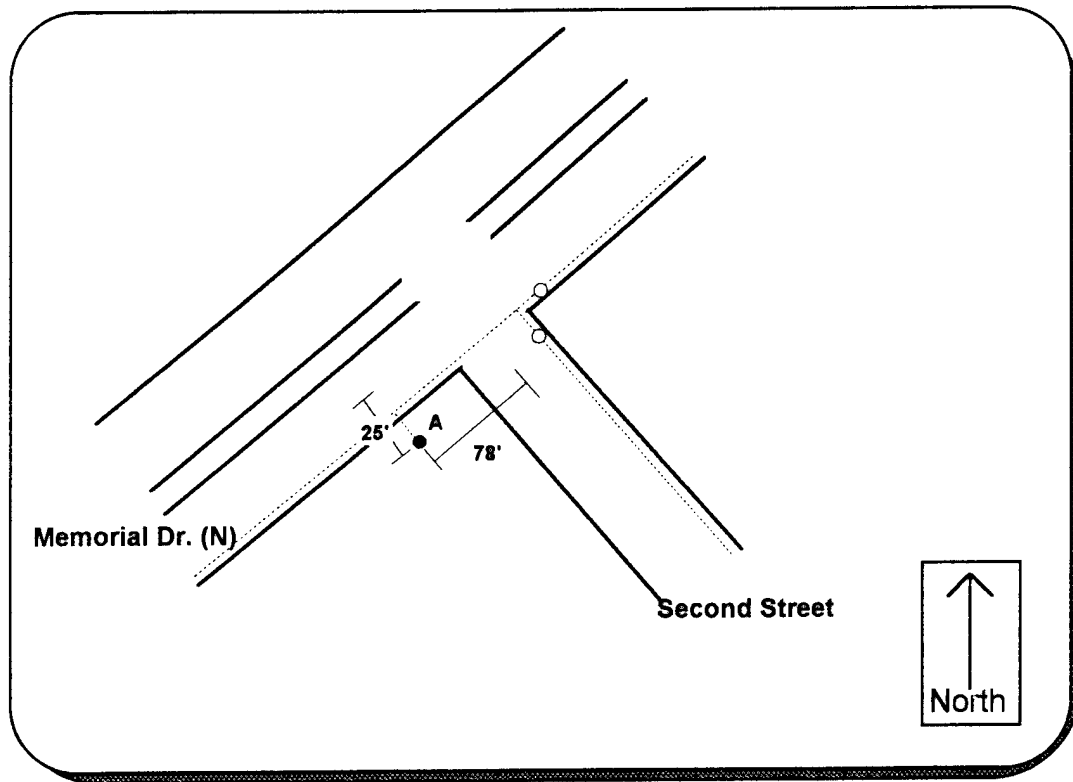
Client: Fort Drum, New York

Time: Leak Survey

Date: Saturday, November 04, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 2-11

Distance: 0' From A

Connection point: A= Hydrant.

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

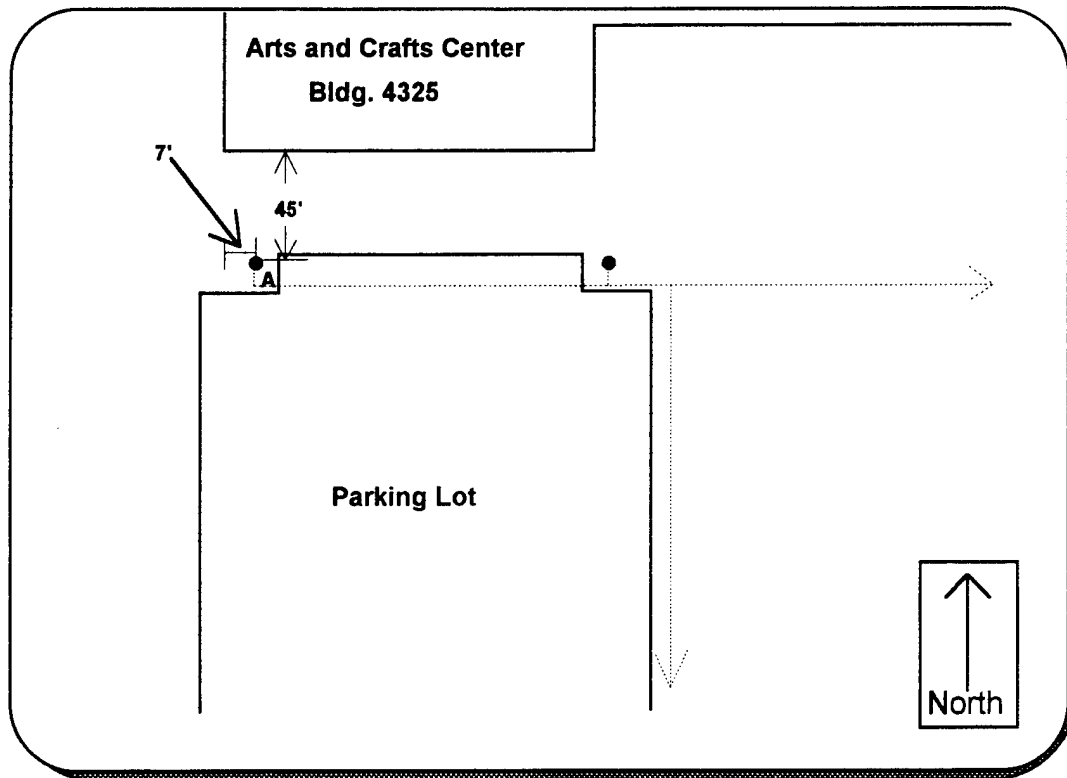
Client: Fort Drum, New York

Time: Leak Survey

Date: Tuesday, November 07, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 3-1

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

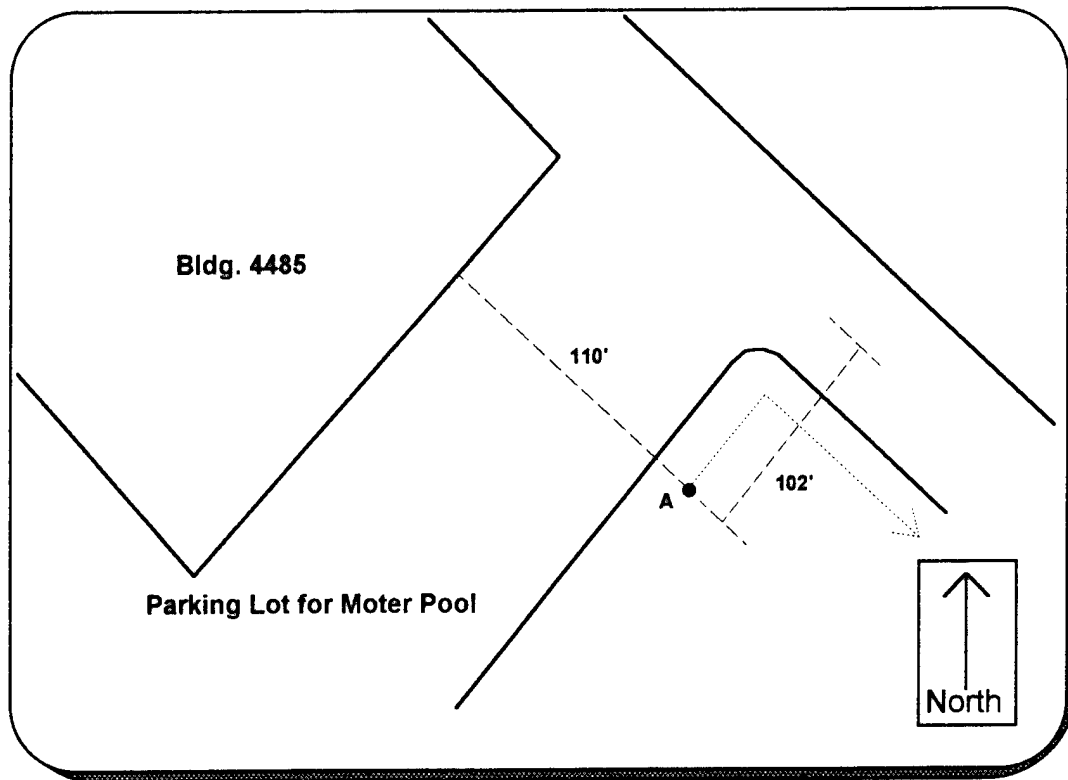
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, November 06, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 3-2

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

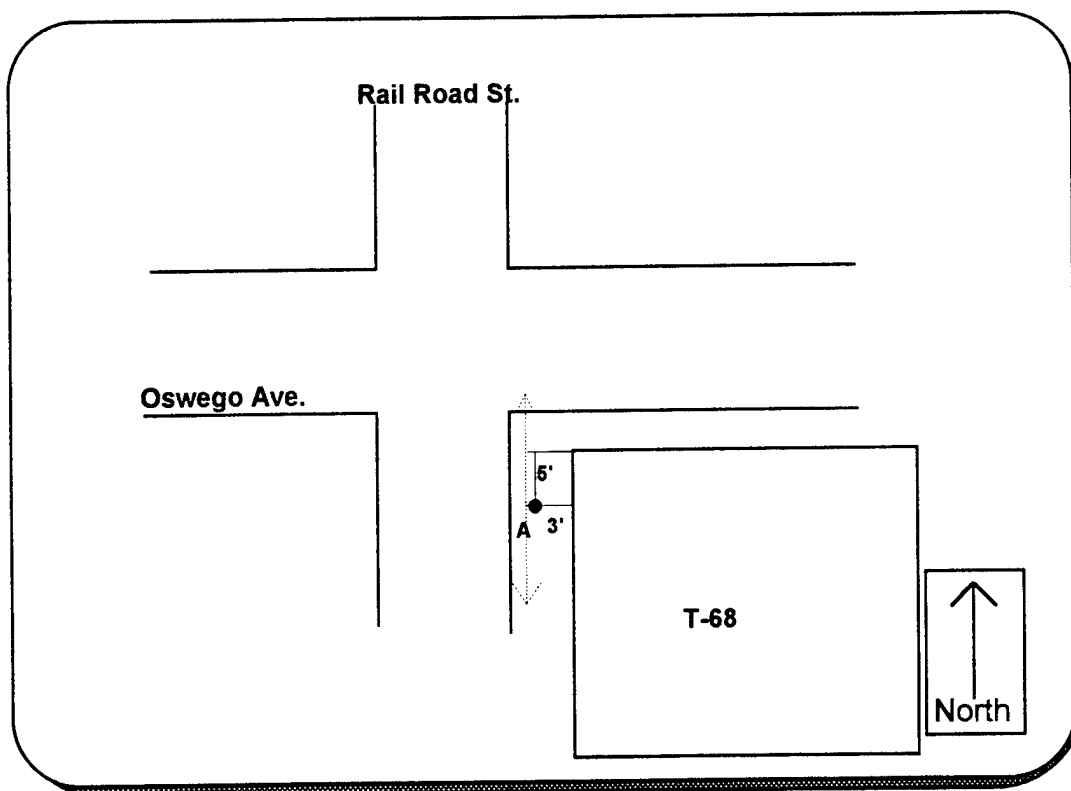
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 4-1

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

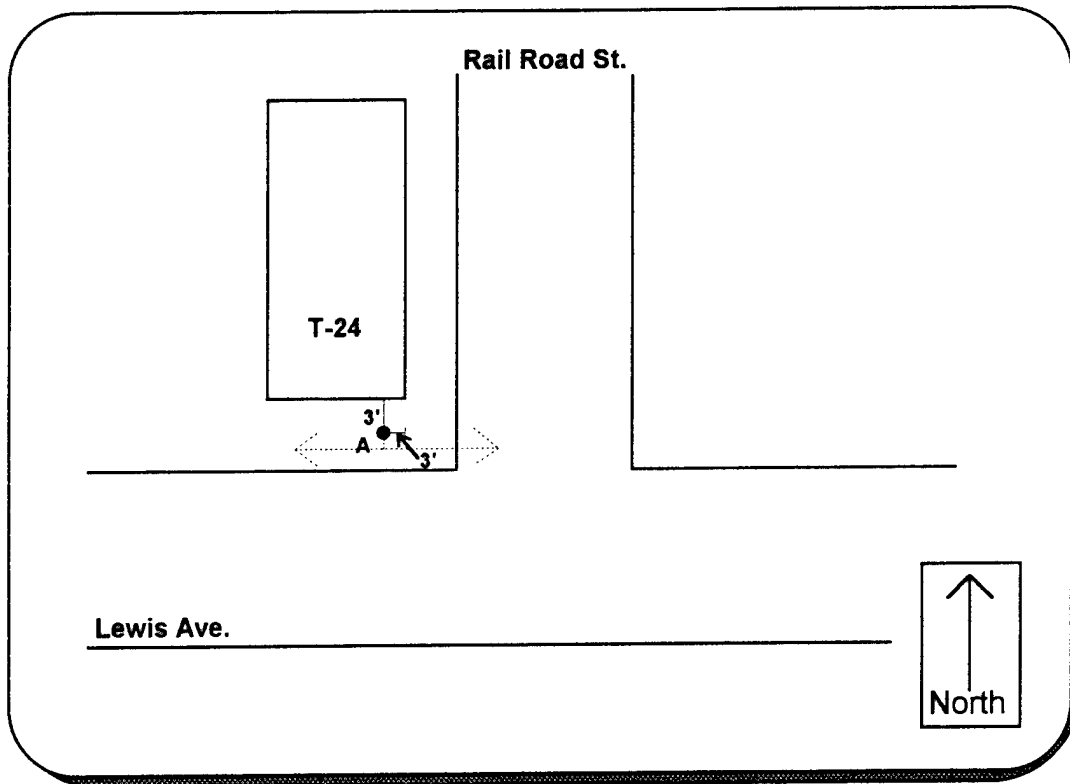
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 4-2

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

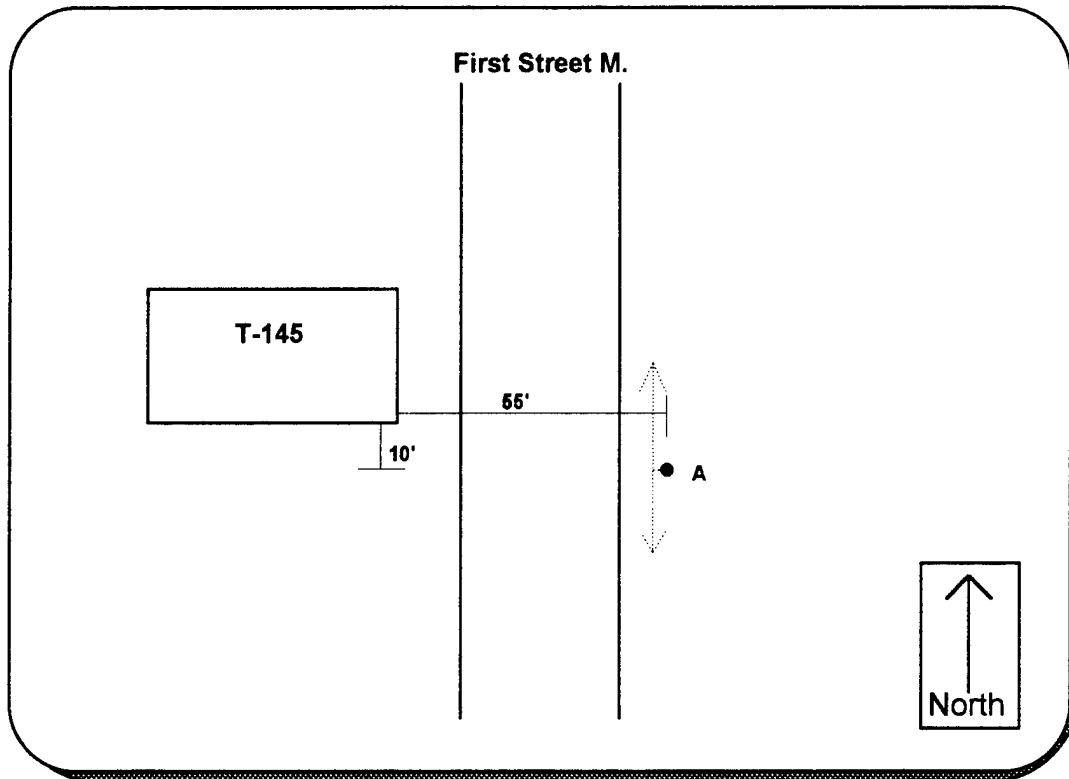
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 4-3

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

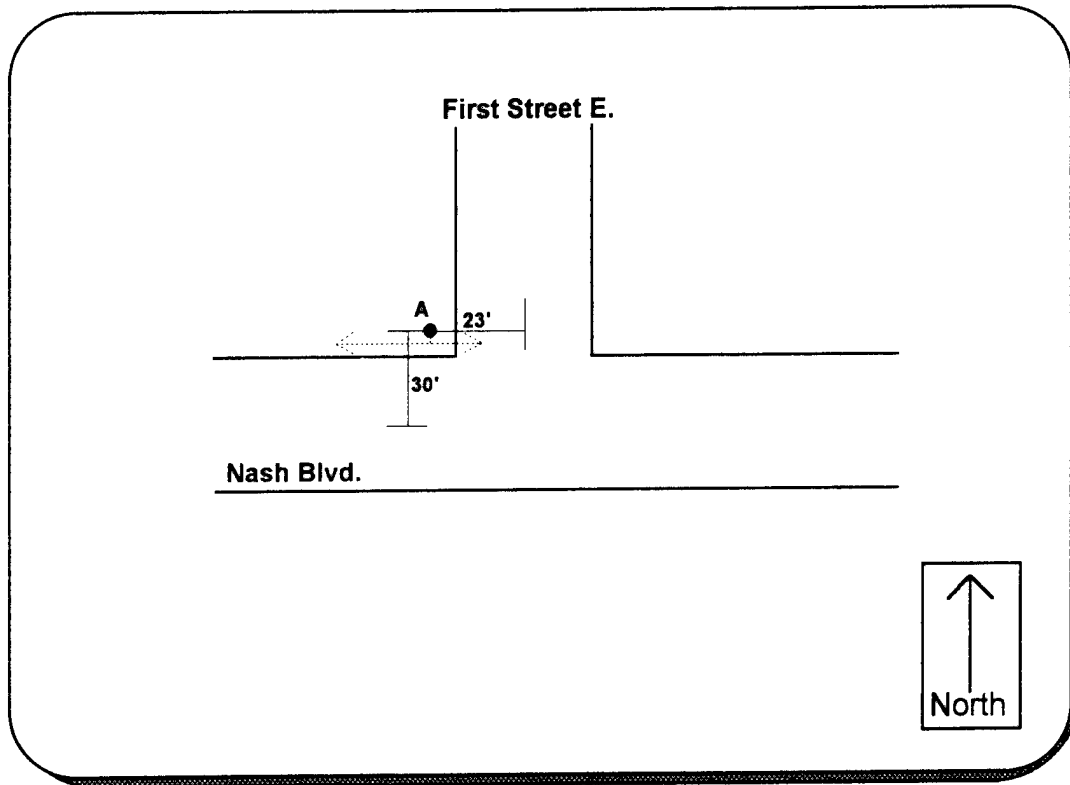
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 4-4

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

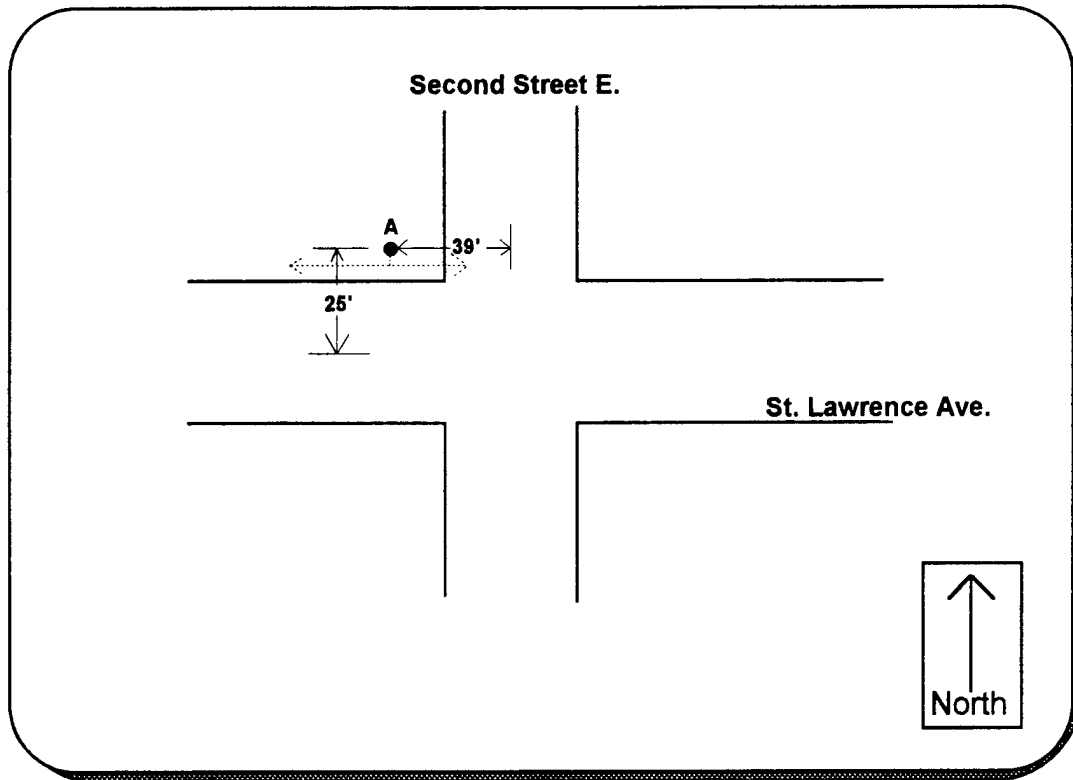
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 4-5

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

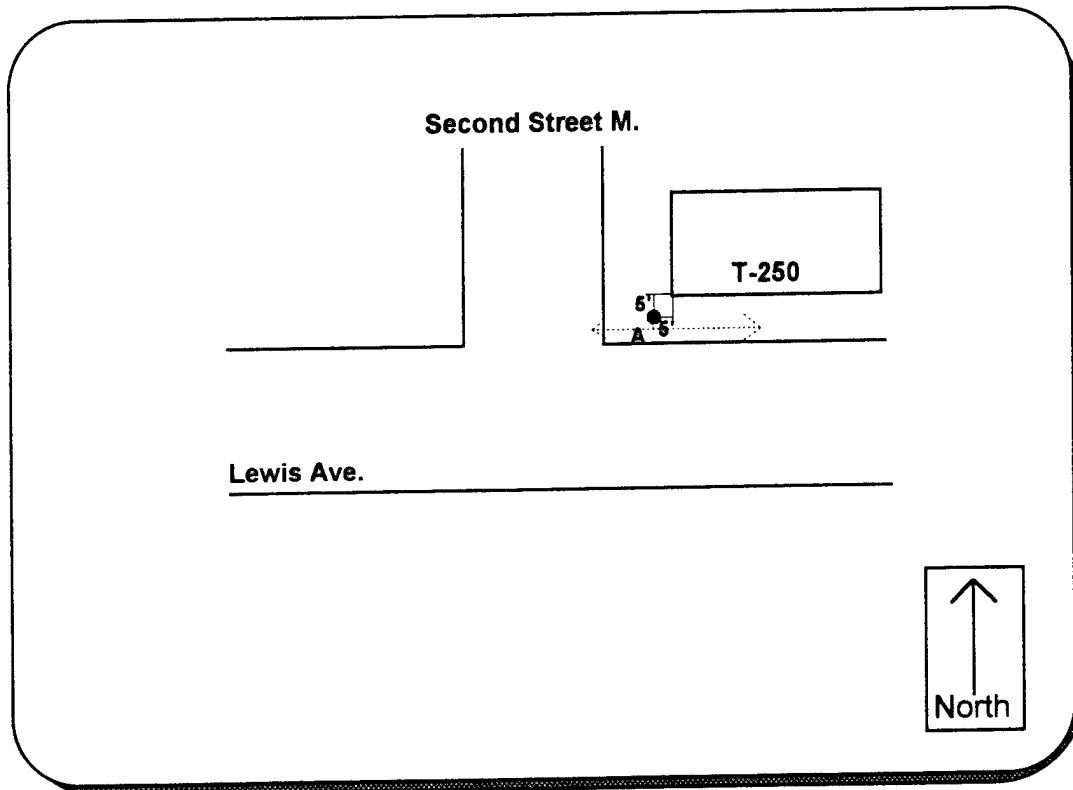
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 4-6

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

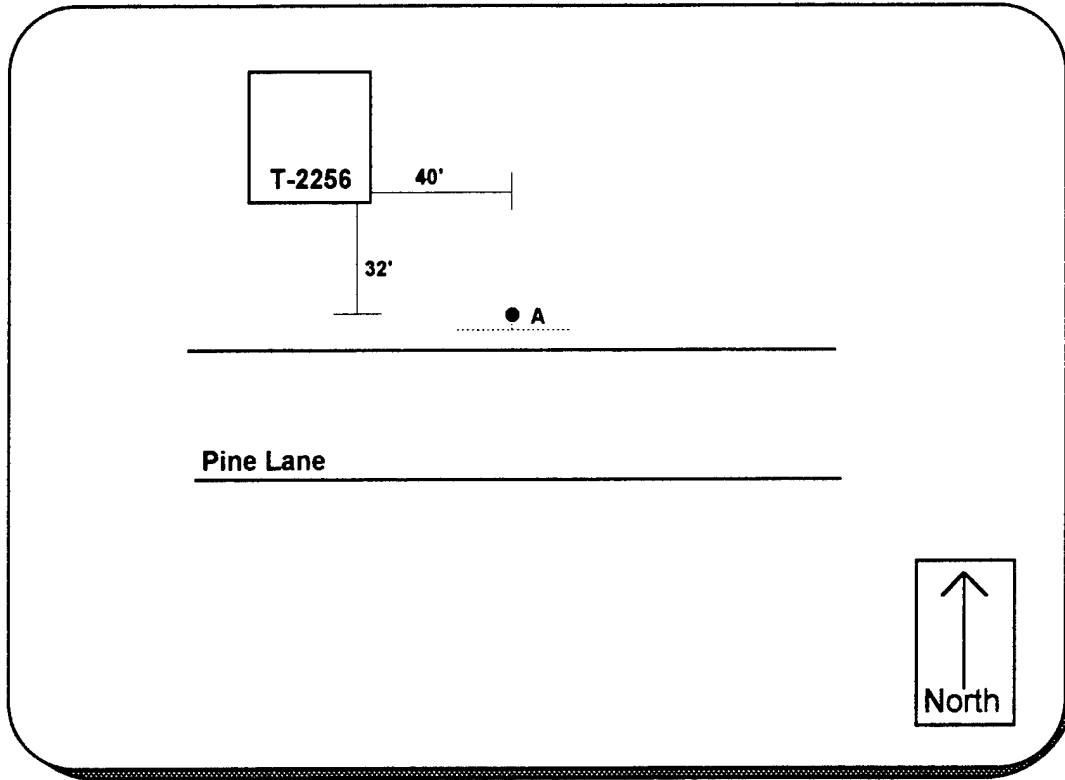
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 4-7

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

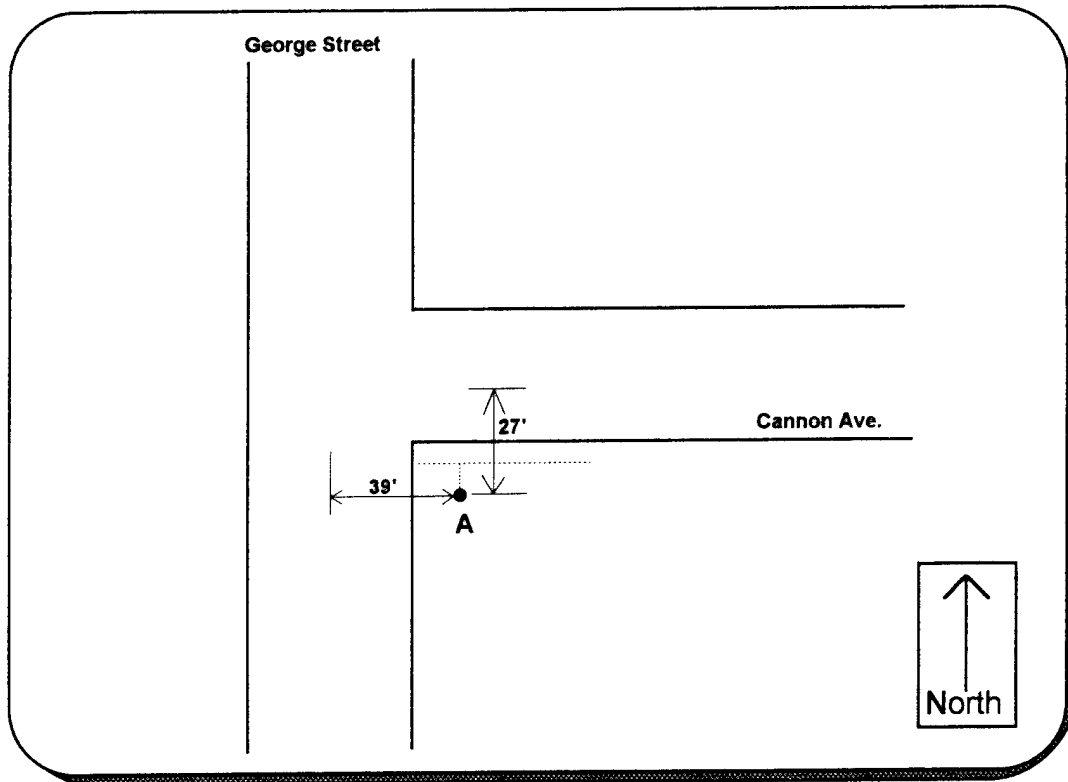
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, October 26, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 5-1

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

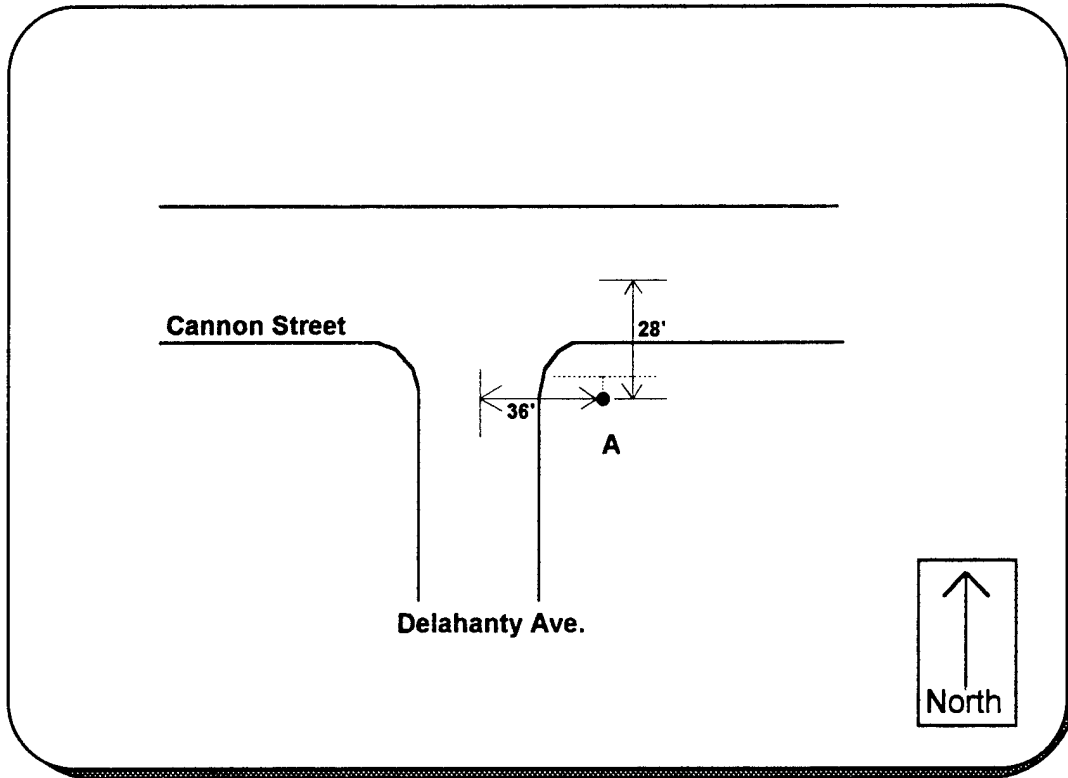
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, October 26, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 5-2

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

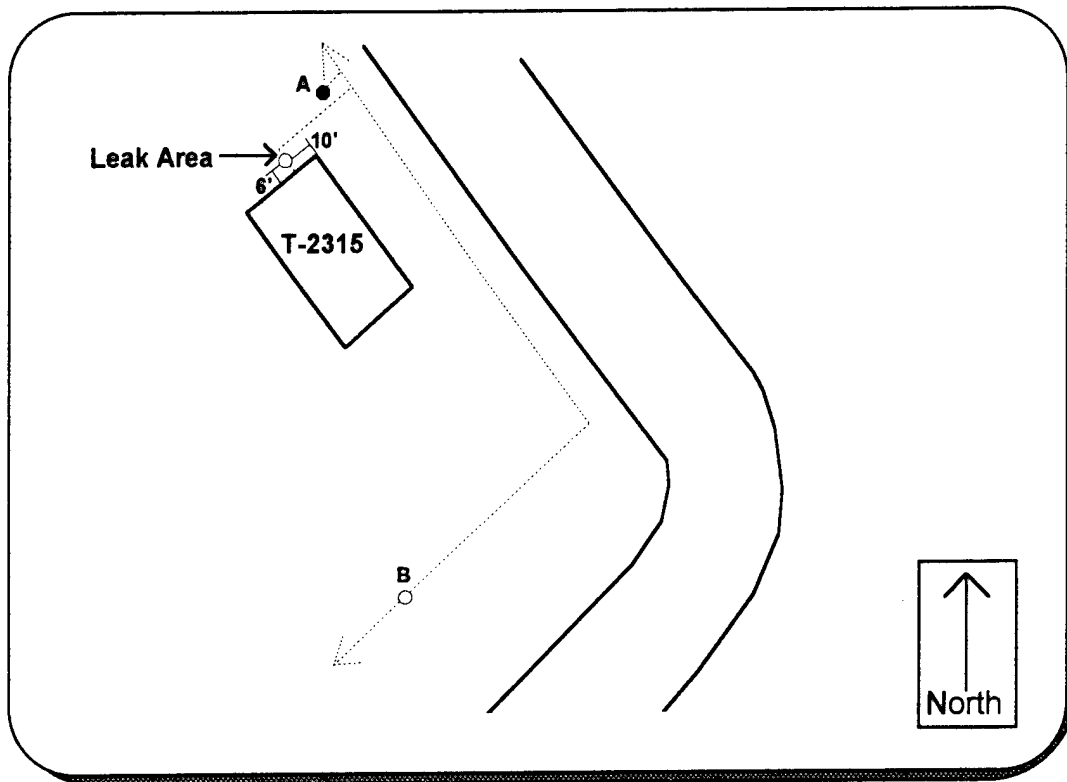
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, October 30, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 5-3

Distance: 320' From A to B.

Connection point: A= Hydrant

Connection point: B= Main line valve

Leak Location: Service valve for T-2315

Comments This is a service leak on the 1 1/2" line going into bldg. T-2315.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

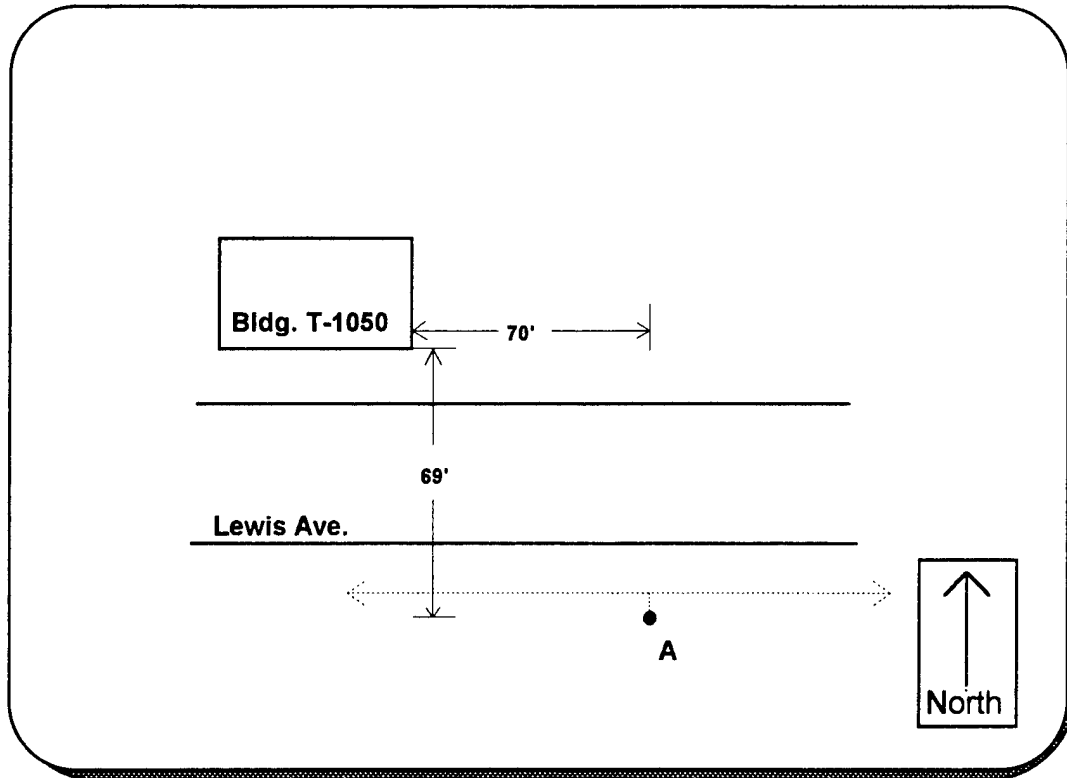
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, October 26, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 5-4

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

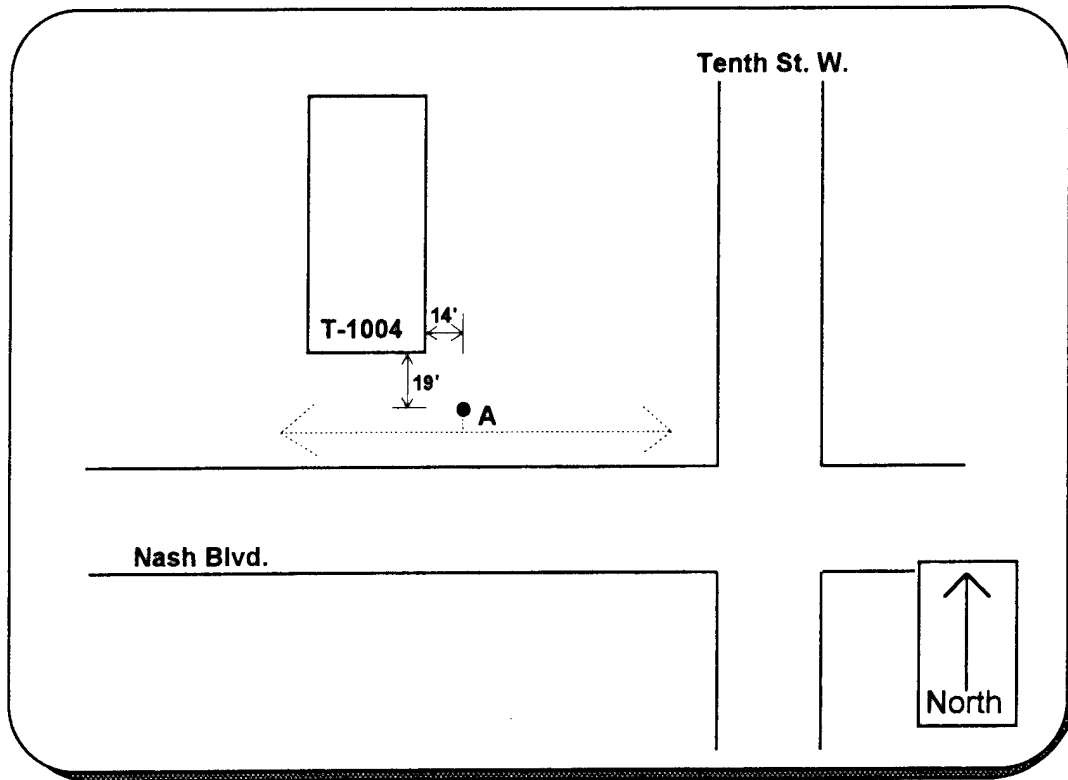
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, October 26, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 5-5

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

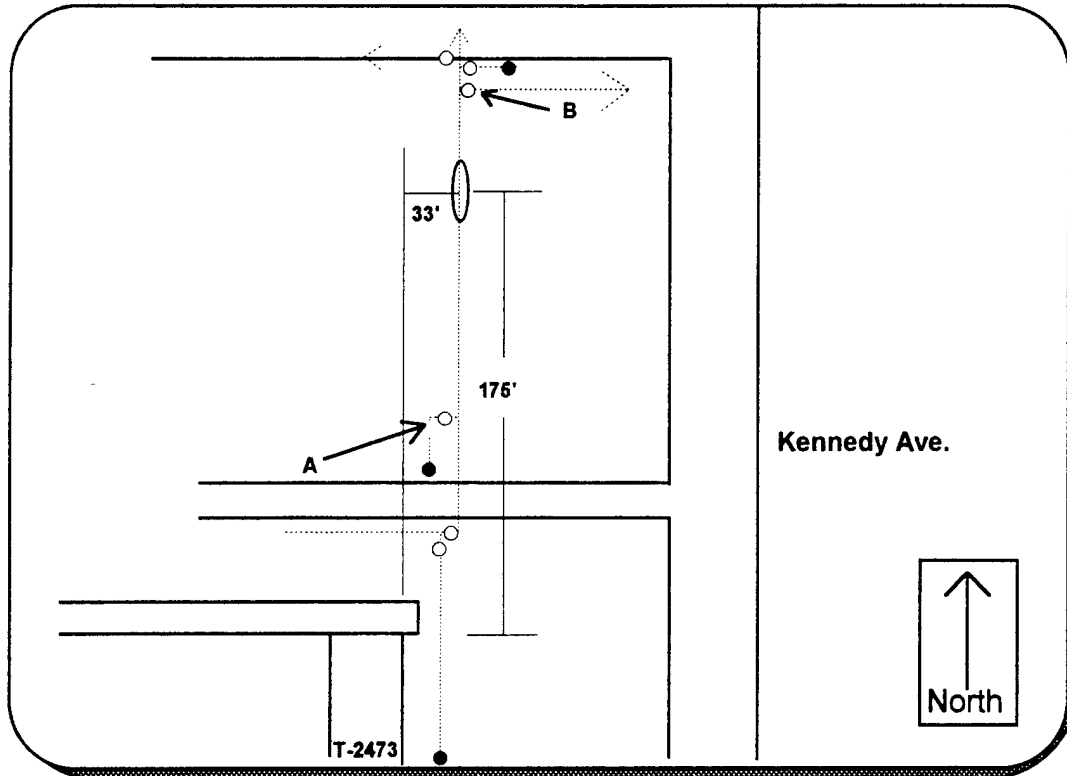
Client: Fort Drum, New York

Time: Leak Survey

Date: Tuesday, October 31, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 5-6

Distance: 187' From A to B.

Connection point: A= 6" Aux. valve for hydrant.

Connection point: B= 8" Main line valve.

Leak Location: 105' N. of A on the 12" Main towards B.

Comments Old 2" service.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

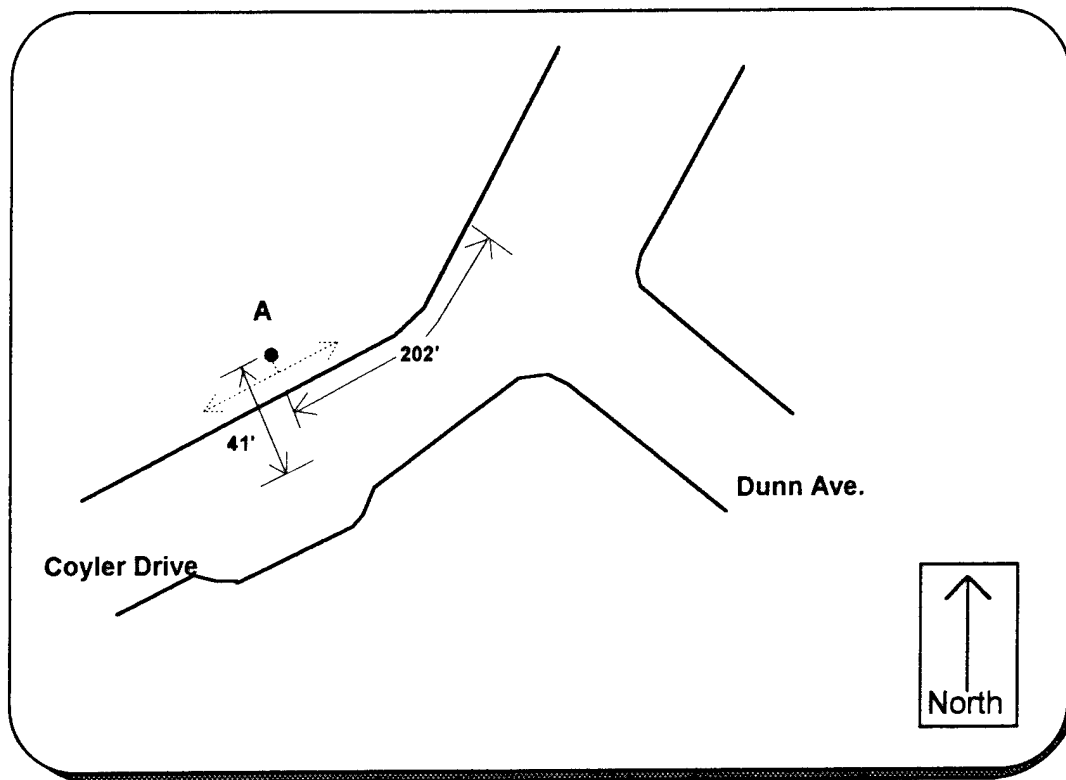
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, October 26, 1995

Tech: Greg and George

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 5-7

Distance: 0' From A.

Connection point: A=Hydrant

Connection point:

Leak Location: 0' From A.

Comments This is a hydrant leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services
LEAK LOCATION REPORT

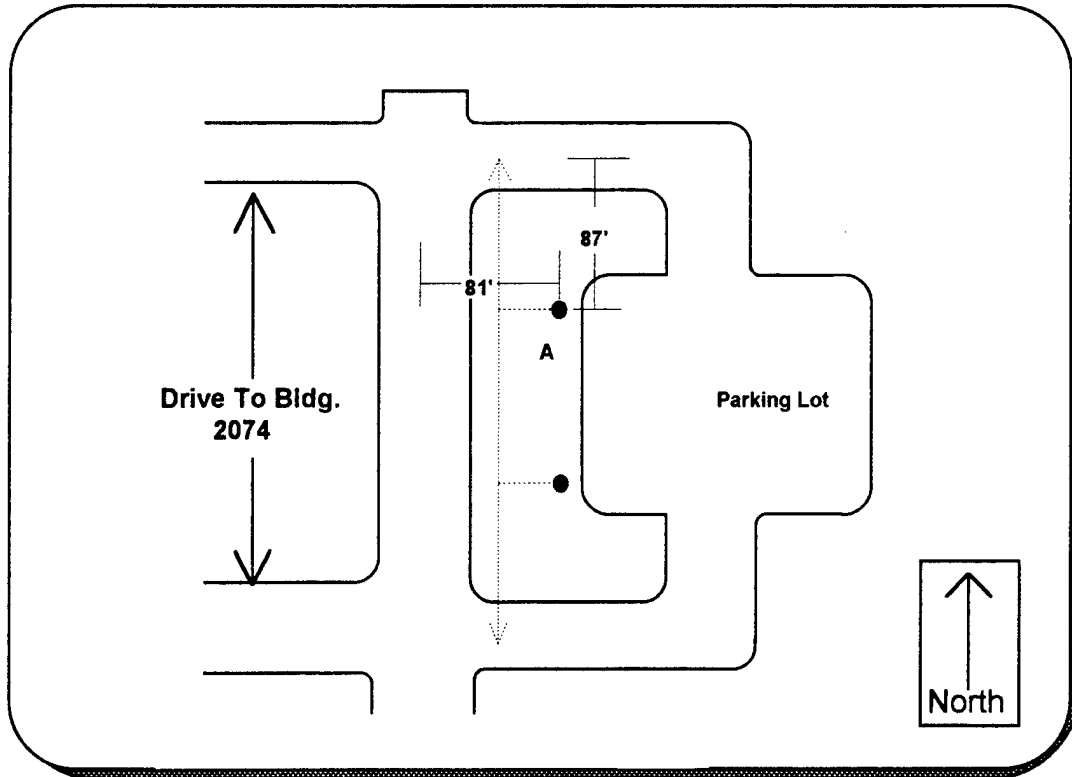
Client: Fort Drum, New York

Time: Leak Survey

Date: Monday, November 06, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 6-1

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This is a hydrant leak. This hydrant is on the high pressure fire protection system for the airport.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

LEAK LOCATION REPORT

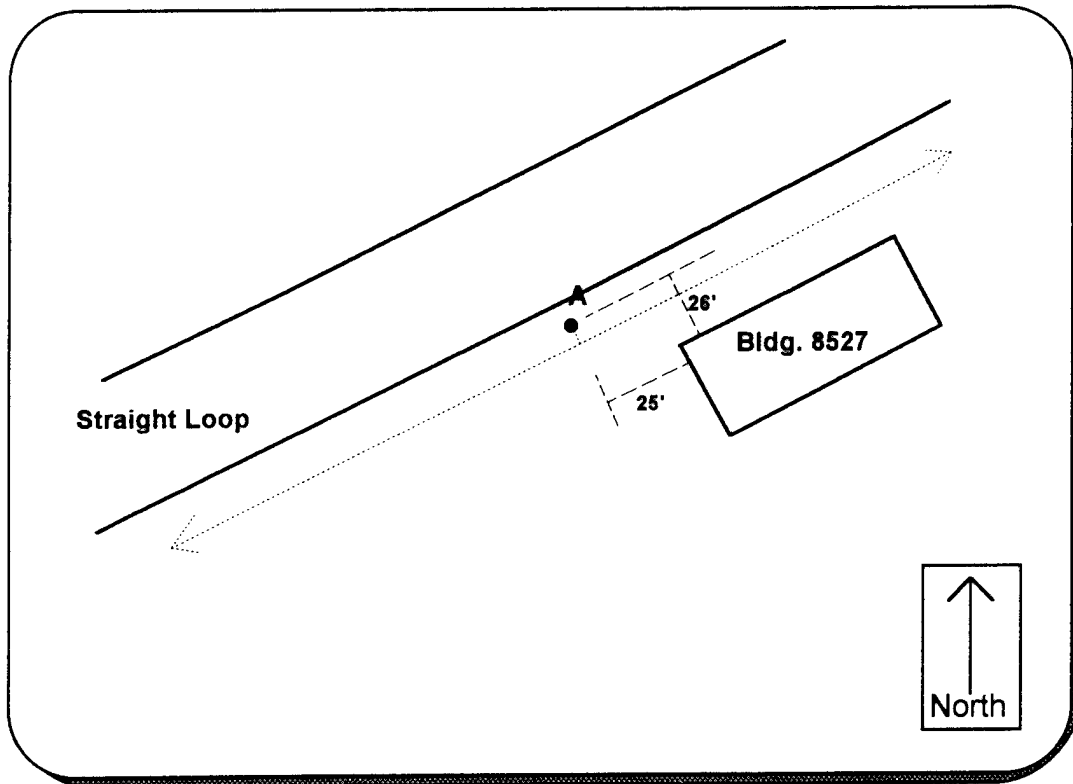
Client: Fort Drum, New York

Time: Leak Survey

Date: Thursday, November 02, 1995

Tech: John and Ray

Below is a diagram of the area surveyed for a suspect leak.



Leak Number: 7-1

Distance: 0' From A

Connection point: A= Hydrant

Connection point:

Leak Location: 0' From A

Comments This was a hydrant leak. Leak noise quit when the hydrant was tightened.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

APPENDIX D
ENERGY AUDIT CALCULATIONS

Energy Cost Calculations

ECO #1 LCCA

ECO #2 LCCA

ECO #3 LCCA

ECO #4 LCCA

ECO #5 LCCA

ECO #6 LCCA

ECO #7 LCCA

Cost Estimate Back-up Data

LCCA Economic Factors

Energy Cost Calculations

ELECTRICAL CONSUMPTION - FT. DRUM (WELLS, RESERVOIR PUMPS) & DANC

A full year of data taken from the telemetry system was taken from August to July.

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total | Reservoir Pump |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------------|
| Avg. (Hours) | 1,098 | 2,070 | 1,585 | 1,050 | 1,954 | 1,315 | 2,146 | 1,331 | 1,676 | 1,007 | 1,283 | 16,515 | 2,614 |
| Flow (gpm) | 410 | 125 | 75 | 410 | 125 | 150 | 75 | 185 | 220 | 285 | 190 | 2,249 | 450 |
| Flow (gal) | 27,004,212 | 15,512,580 | 7,122,039 | 25,823,700 | 14,642,104 | 11,827,110 | 9,642,975 | 14,765,315 | 22,112,138 | 17,213,054 | 14,617,732 | 180,282,960 | |
| Motor HP | 40 | 20 | 15 | 40 | 15 | 15 | 15 | 20 | 25 | 40 | 30 | - | 40 |
| Motor Effic. | 89.5% | 87.5% | 86.0% | 89.5% | 86.0% | 86.0% | 86.0% | 87.5% | 88.0% | 89.5% | 88.5% | - | 89.5% |
| Motor kW | 25.0 | 12.8 | 9.8 | 25.0 | 9.8 | 9.8 | 9.8 | 12.8 | 15.9 | 25.0 | 19.0 | 174.49 | 25.0 |
| Motor kWh | 27,456.1 | 26,472.3 | 15,467.6 | 26,255.9 | 19,068.5 | 12,832.7 | 20,942.2 | 17,021.6 | 26,639.8 | 25,180.6 | 24,333.5 | 241,670.9 | 65,364.6 |
| kWh Cost | \$1,977 | \$1,906 | \$1,114 | \$1,890 | \$1,373 | \$924 | \$1,508 | \$1,226 | \$1,918 | \$1,813 | \$1,752 | \$17,400 | \$4,706 |

COST OF WATER - DISTRIBUTION SYSTEM - BASED ON 1995 WATER PRICES

Avg. KW: 15.86
Avg. GPM: 204.44

Total Ft. Drum O&M Cost: \$20,105
Total Chemical Treatment Cost: \$5,550
(Based on FY95 value supplied by Ft. Drum)
(=5550 * Flow Rate/180,282,960)

Total Well Operation (hrs): 16,515
Total Well kWh Cost: \$17,400
Total Well Production (gal): 180,282,960
Cost of Drum Water (per kGal) \$0.097
(Based on \$0.072/kWh)
(Average value per year from Aug-93 to Jul-95)

Total Reservoir Pump Cost: \$4,706
Total Reservoir Pump (gal): 70,578,000
Cost of Res. Water (per kGal): \$0.067
(Based on \$0.072/kWh)
(Based on flow rate of 450 gpm)

DANC - Variable Costs: \$476,527
DANC Production (gal): 529,017,693
Total DANC Cost (per kGal): \$0.90
(Average value per year from Aug-93 to Jul-95)
(Taken from Schedule A for 1997)

| | DANC Water Cost / kGal | Ft. Drum Electrical Cost / kGal | Ft. Drum O & M Cost/ kGal | Ft. Drum Chem. Cost | Reservoir Pump Cost/ kGal |
|-------------|------------------------|---------------------------------|---------------------------|---------------------|---------------------------|
| Total Cost: | \$0.90 | \$0.097 | \$20,105 | \$5,550 | \$4.706 |
| | 529,018 | 180,283 | 709,301 | 180,283 | 70,578 |
| Total Cost: | \$0.90 | \$0.097 | \$0.028 | \$0.031 | \$0.067 |
| | 74,58% | 25.42% | | | |
| Total Cost: | \$0.672 | \$0.025 | \$0.028 | \$0.031 | \$0.067 |
| Total Cost: | \$0.32 per kGal | | | | |

DANC WATER - CALCULATION OF FIXED & VARIABLE COSTS

It was assumed for the economic analysis that Ft. Drum will pay for DANC water fixed costs regardless of water consumption. Therefore, cost of water and water savings will only be based on DANC variable costs, not fixed costs.

| DANC Costs: | | Fixed | | | Variable | | | Variable | | | Fixed | | | Variable | | | Total | |
|---------------|-------------|-----------------------------|-----------------------------|-------------------------------|--------------------------------------|----------------------|----------------------|-------------------------|----------------------|-------------------------|----------------------------|-------------------------------|----------------------|----------------------|----------------------|----------------------|-------|--|
| Economic Year | Date | City Capital Cost (\$/kgal) | DANC Capital Cost (\$/kgal) | DANC Overhead Costs (\$/kgal) | Combined Cap. and Overhead (\$/kgal) | City O & M (\$/kgal) | DANC O & M (\$/kgal) | City O&M Cost (\$/kgal) | DANC O & M (\$/kgal) | DANC O&M Cost (\$/kgal) | Total Fixed Cost (\$/kgal) | Total Variable Cost (\$/kgal) | Total Cost (\$/kgal) | Total Cost (\$/kgal) | Total Cost (\$/kgal) | Total Cost (\$/kgal) | | |
| 1 | 4/95 - 3/96 | \$0.57 | \$2,632,305 | \$4.81 | \$86,203 | \$0.16 | \$3,032,562 | \$222,873 | \$167,451 | \$0.41 | \$2,946,354 | \$5.38 | \$476,527 | \$0.87 | \$3,422,886 | \$6.25 | | |
| 2 | 4/96 - 3/97 | \$0.57 | \$1,535,136 | \$2.80 | \$88,359 | \$0.16 | \$1,937,547 | \$228,384 | \$0.42 | \$1,849,185 | \$3.38 | \$488,380 | \$0.89 | \$2,337,569 | \$4.27 | | | |
| 3 | 4/97 - 3/98 | \$0.57 | \$0 | \$0.00 | \$90,587 | \$0.17 | \$404,817 | \$234,093 | \$0.43 | \$175,928 | \$0.57 | \$500,588 | \$0.91 | \$814,638 | \$1.49 | | | |
| 4 | 4/98 - 3/99 | \$0.57 | \$0 | \$0.00 | \$92,831 | \$0.17 | \$409,202 | \$239,946 | \$0.44 | \$180,326 | \$0.57 | \$513,103 | \$0.94 | \$827,153 | \$1.51 | | | |
| 5 | 4/99 - 3/00 | \$0.57 | \$0 | \$0.00 | \$95,152 | \$0.17 | \$418,435 | \$243,944 | \$0.45 | \$184,835 | \$0.57 | \$523,931 | \$0.96 | \$837,960 | \$1.53 | | | |
| 6 | 4/00 - 3/01 | \$0.57 | \$0 | \$0.00 | \$97,530 | \$0.18 | \$411,580 | \$252,093 | \$0.46 | \$189,455 | \$0.57 | \$539,078 | \$0.98 | \$853,128 | \$1.56 | | | |
| 7 | 4/01 - 3/02 | \$0.57 | \$0 | \$0.00 | \$99,966 | \$0.18 | \$414,016 | \$258,395 | \$0.47 | \$194,192 | \$0.57 | \$552,553 | \$1.01 | \$866,602 | \$1.58 | | | |
| 8 | 4/02 - 3/03 | \$0.57 | \$0 | \$0.00 | \$102,468 | \$0.19 | \$416,518 | \$264,855 | \$0.48 | \$199,047 | \$0.57 | \$566,370 | \$1.03 | \$880,419 | \$1.61 | | | |
| 9 | 4/03 - 3/04 | \$0.57 | \$0 | \$0.00 | \$105,029 | \$0.19 | \$419,079 | \$271,477 | \$0.50 | \$209,123 | \$0.57 | \$580,529 | \$1.06 | \$894,578 | \$1.63 | | | |
| 10 | 4/04 - 3/05 | \$0.57 | \$0 | \$0.00 | \$107,655 | \$0.20 | \$421,705 | \$278,263 | \$0.51 | \$209,123 | \$0.57 | \$595,041 | \$1.09 | \$909,091 | \$1.66 | | | |
| 11 | 4/05 - 3/06 | \$0.57 | \$0 | \$0.00 | \$110,344 | \$0.20 | \$424,394 | \$285,220 | \$0.52 | \$214,351 | \$0.57 | \$609,915 | \$1.11 | \$923,965 | \$1.69 | | | |
| 12 | 4/06 - 3/07 | \$0.57 | \$0 | \$0.00 | \$113,105 | \$0.21 | \$427,155 | \$292,351 | \$0.53 | \$219,710 | \$0.57 | \$625,166 | \$1.14 | \$939,216 | \$1.72 | | | |
| 13 | 4/07 - 3/08 | \$0.57 | \$0 | \$0.00 | \$115,933 | \$0.21 | \$429,983 | \$299,659 | \$0.55 | \$225,203 | \$0.57 | \$640,795 | \$1.17 | \$954,845 | \$1.74 | | | |
| 14 | 4/08 - 3/09 | \$0.49 | \$0 | \$0.00 | \$118,831 | \$0.22 | \$435,492 | \$307,151 | \$0.56 | \$230,833 | \$0.42 | \$656,815 | \$1.20 | \$923,477 | \$1.69 | | | |
| 15 | 4/09 - 3/10 | \$0.33 | \$0 | \$0.00 | \$121,802 | \$0.22 | \$430,238 | \$314,830 | \$0.58 | \$236,604 | \$0.33 | \$673,236 | \$1.23 | \$853,672 | \$1.56 | | | |
| 16 | 4/10 - 3/11 | \$0.27 | \$0 | \$0.00 | \$124,847 | \$0.23 | \$427,082 | \$322,700 | \$0.59 | \$242,519 | \$0.44 | \$690,066 | \$1.26 | \$835,301 | \$1.53 | | | |
| 17 | 4/11 - 3/12 | \$0.05 | \$0 | \$0.00 | \$127,968 | \$0.23 | \$427,082 | \$330,768 | \$0.60 | \$248,582 | \$0.45 | \$707,318 | \$1.29 | \$733,394 | \$1.34 | | | |
| 18 | 4/12 - 3/13 | \$0 | \$0.00 | \$0 | \$131,167 | \$0.24 | \$427,082 | \$339,037 | \$0.62 | \$254,796 | \$0.47 | \$725,000 | \$1.32 | \$725,000 | \$1.32 | | | |
| 19 | 4/13 - 3/14 | \$0 | \$0.00 | \$0 | \$134,446 | \$0.25 | \$427,082 | \$347,513 | \$0.63 | \$261,166 | \$0.48 | \$743,125 | \$1.36 | \$743,125 | \$1.36 | | | |
| 20 | 4/14 - 3/15 | \$0 | \$0.00 | \$0 | \$137,807 | \$0.25 | \$427,082 | \$356,201 | \$0.65 | \$267,696 | \$0.49 | \$761,704 | \$1.39 | \$761,704 | \$1.39 | | | |

Costs based on guaranteed annual water production of 1.5 million gallons per day, 547,500,000 gallons per year.

| | | | | |
|----------------------------|---------|--------|------------|--------|
| Cost of Water/kgal (1995): | (Fixed) | \$5.38 | (Variable) | \$0.87 |
| Cost of Water/kgal (1996): | (Fixed) | \$3.38 | (Variable) | \$0.89 |
| Cost of Water/kgal (1997): | (Fixed) | \$0.57 | (Variable) | \$0.91 |

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JOB Ft. Drum Water Study 1406-012
SHEET NO. 1 OF 4
CALCULATED BY TER DATE 1-31-96
CHECKED BY _____ DATE _____
SCALE Utility Charges - Ft. Drum

Cost of Water - Ft. Drum

The total cost of water at Ft. Drum can be separated into the following categories:

- Ft. Drum Electrical Charges (Well Pumps)
- Ft. Drum O + M Charges (Wells, Distribution Piping, Chemicals)
- DANC Electrical Charges
- DANC O + M Charges
- DANC Capitalization and Overhead Charges
- City of Watertown Capitalization Charges

DANC + City of Watertown Costs

Ft. Drum pays a single fee (\$/KGal) for a contracted amount of 1.5 MGD of water from DANC. This fee includes:

- DANC Electrical Costs
- DANC O + M Costs
- DANC Capital and Overhead Costs
- City of Watertown Capital Costs

Cost was taken from DANC Water Line Schedule "A" for the period of 4/1/95 to 3/31/96:

| |
|-------------------------------|
| Total DANC Cost = \$6.25/KGal |
|-------------------------------|

Note: Ft. Drum is contractually obligated to pay for 1.5 MGD (547,500,000 gal/yr) or more, if more is used.

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JOB Ft. Drum Water Study 1406-012
 SHEET NO. 2 OF 4
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 CHECKED BY _____ DATE _____
 SCALE Water Costs - Ft. Drum

Ft. Drum Electrical Charges

From the Ft. Drum utility office:

Monthly electrical charge = \$3,172/mo.

Demand KW = \$7.02/KW

On Peak KWH = \$0.06196/KWH

Off Peak KWH = \$0.05197/KWH

Bundled electrical charge = \$0.072/KWH which includes all demand, consumption, customer charges that Ft. Drum pays.

Pump Electrical Costs - Wells

Total Cost (wells) = Σ (All well KWH)

$KWH_{well} = KW (Hours)$

$KW_{well} = \frac{(HP)(0.746)(LF)}{\eta_m}$

$\therefore \text{Electrical Cost}_{wells} = \Sigma \frac{(HP)(0.746)(LF)(Hours)}{\eta_m}$

where: KW = demand

KWH = consumption

HP = motor horsepower

LF = motor load factor
(assume 75%)

0.746 = HP to KW conversion

η_m = motor efficiency

(Assume standard efficiency motor)

Hours = Annual Operating Hours

Table 2. Nominal Full-Load Efficiencies from the National Energy Policy Act of 1992

| Motor (hp) | Number of Poles | | | | | | |
|------------|-----------------|------|------|---------------|------|------|--|
| | Open Motors | | | Closed Motors | | | |
| | 2 | 4 | 6 | 2 | 4 | 6 | |
| 1 | — | 82.5 | 80.0 | 75.5 | 82.5 | 80.0 | |
| 1.5 | 82.5 | 84.0 | 84.0 | 82.5 | 84.0 | 85.5 | |
| 2 | 84.0 | 84.0 | 85.5 | 84.0 | 84.0 | 86.5 | |
| 3 | 84.0 | 86.5 | 86.5 | 85.5 | 87.5 | 87.5 | |
| 5 | 85.5 | 87.5 | 87.5 | 87.5 | 87.5 | 87.5 | |
| 7.5 | 87.5 | 88.5 | 88.5 | 88.5 | 89.5 | 89.5 | |
| 10 | 88.5 | 89.5 | 90.2 | 89.5 | 89.5 | 89.5 | |
| 15 | 89.5 | 91.0 | 90.2 | 90.2 | 91.0 | 90.2 | |
| 20 | 90.2 | 91.0 | 91.0 | 90.2 | 91.0 | 90.2 | |
| 25 | 91.0 | 91.7 | 91.7 | 91.0 | 92.4 | 91.7 | |
| 30 | 91.0 | 92.4 | 92.4 | 91.0 | 92.4 | 91.7 | |
| 40 | 91.7 | 93.0 | 93.0 | 91.7 | 93.0 | 93.0 | |
| 50 | 92.4 | 93.0 | 93.0 | 92.4 | 93.0 | 93.0 | |
| 60 | 93.0 | 93.6 | 93.6 | 93.0 | 93.6 | 93.6 | |
| 75 | 93.0 | 94.1 | 93.6 | 93.0 | 94.1 | 93.6 | |
| 100 | 93.0 | 94.1 | 94.1 | 93.6 | 94.5 | 94.1 | |
| 125 | 93.6 | 94.5 | 94.1 | 94.5 | 94.5 | 94.1 | |
| 150 | 93.6 | 95.0 | 94.5 | 94.5 | 95.0 | 95.0 | |
| 200 | 94.5 | 95.0 | 94.5 | 95.0 | 95.0 | 95.0 | |

Notes: 1) Manufactured by October 25, 1997

2) Manufactured by October 25 1999 for motors requiring certification from a nationally recognized safety testing laboratory.

motors where efficiency, full load speed, power factor, cost and other information are available. Because no one manufacturer has the most efficient motor in every size or type, users should comparison shop. Manufacturers also change their designs from time to time, so it is very important to obtain up-to-date efficiency, full load speed, cost, etc., information from the manufacturers.

Table 3. Typical Efficiencies of Electric Motors

| Typical Standard Motors | | | Typical Energy-Efficient Motors | | |
|--|--------------------------|----------------------------|---|--------------------------|----------------------------|
| Full Load Efficiencies of NEMA Design B Induction Motors ↙ | | | Full Load Efficiencies of Three Phase, Four Pole Motors | | |
| hp | Nominal Efficiency Range | Average Nominal Efficiency | hp | Nominal Efficiency Range | Average Nominal Efficiency |
| 1.0 | 68.0-78.0 | 73.0 | 1.0 | 80.0-84.0 | 83.0 |
| 1.5 | 68.0-80.0 | 75.0 | 1.5 | 81.0-84.0 | 83.0 |
| 2.0 | 72.0-81.0 | 77.0 | 2.0 | 81.0-84.0 | 83.0 |
| 3.0 | 74.0-83.0 | 80.0 | 3.0 | 83.5-89.5 | 86.5 |
| 5.0 | 78.0-85.0 | 82.0 | 5.0 | 85.0-90.2 | 87.6 |
| 7.5 | 80.0-87.0 | 84.0 | 7.5 | 86.0-91.0 | 88.5 |
| 10.0 | 81.0-88.0 | 85.0 | 10.0 | 87.5-91.7 | 89.6 |
| 15.0 | 83.0-89.0 | 86.0 | 15.0 | 89.5-92.4 | 91.0 |
| 20.0 | 84.0-89.0 | 87.5 | 20.0 | 90.0-93.2 | 91.6 |
| 25.0 | 85.0-90.0 | 88.0 | 25.0 | 91.0-94.1 | 92.6 |
| 30.0 | 86.0-90.5 | 88.5 | 30.0 | 91.0-94.5 | 92.8 |
| 40.0 | 87.0-91.5 | 89.5 | 40.0 | 91.5-94.5 | 93.0 |
| 50.0 | 88.0-92.0 | 90.0 | 50.0 | 91.5-95.0 | 93.2 |
| 60.0 | 88.5-92.0 | 90.5 | 60.0 | 91.7-95.0 | 93.3 |
| 75.0 | 89.5-92.5 | 91.0 | 75.0 | 92.0-95.0 | 93.5 |
| 100.0 | 90.0-93.0 | 91.5 | 100.0 | 93.0-95.0 | 94.0 |
| 125.0 | 90.5-93.0 | 92.0 | 125.0 | 93.0-95.4 | 94.2 |
| 150.0 | 91.0-93.5 | 92.5 | 150.0 | 93.5-95.8 | 94.6 |
| 200.0 | 91.5-94.0 | 93.0 | 200.0 | 94.4-96.2 | 95.3 |

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JOB Ft. Drum Water Study 1486-012
SHEET NO. 3 OF 4
CALCULATED BY TCP DATE 1/31/96
CHECKED BY _____ DATE _____
SCALE Water Costs - Ft. Drum

Ft. Drum Operation and Maintenance Costs

Costs taken from Ft. Drum personnel:

FY-94: \$22,127

FY-95: \$25,655

Costs include labor, equipment rental, and supplies (including \$5,550 for chemicals in FY-95) directly attributed to the water distribution system.

$$O + M \text{ Cost} = \frac{\text{Annual } O + M \text{ Cost}}{\text{Annual Water Production}} \quad (\$/\text{K GAL})$$

- Assume O+M Cost will be product of FY-95 figure.
- Assume that O+M Costs will be applied to entire water distribution system, with both DANC and Ft. Drum well production figures used.

$$\therefore \text{Total } O + M \text{ Cost} = \frac{\text{Annual Budgeted } O + M \text{ Cost}}{\text{DANC Water} + \text{Ft. Drum Well Water}} \quad [\$/\text{K GAL}]$$

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 SCALE Water Costs - Ft. Drum

Reservoir Pump Costs

In addition to the electrical and O+M costs directly attributed to water production (wells and DANC), there is an additional electrical cost for operating the 40 hp draining pump at the ground reservoir.

This cost is calculated separately of the wells because the reservoir stores water from both the wells and from DANC. Therefore, a cost per total volume of water was determined.

Assume that O+M costs for the reservoir are covered under Ft. Drum's total O+M budget. The cost for just the reservoir should be small compared to the rest of the distribution system.

Reservoir Pump Cost:

Avg. Operating Hours = 156,850 min. = 2614 hrs.
 (taken from telemetry data)

$$\text{Cost} = \frac{(\text{HP})(0.746)(\text{LF})(\text{Hours})}{\eta_m} = \frac{(40)(0.746)(0.75)(2614)(0.072/\text{kWh})}{0.895}$$

$$\text{Cost} = \underline{\$4707} \text{ for } \underline{65,369 \text{ KWH/year}}$$

$$\text{Cost/kgal} = \frac{\text{Total Electrical Cost}}{\text{Water Pumped}} = \frac{\text{Total Electrical Cost}}{(\text{Pump GPM})(\text{Operating Time})}$$

$$\text{Cost/kgal} = \frac{\$4707}{(450 \text{ gpm})(156,850 \text{ min})(1/1000 \text{ kgal})}$$

$$\boxed{\text{Cost/kgal} = \$0.067/\text{kgal}}$$

*Ft. Drum Electrical Rates provided
by Ft. Drum utility office:*

Rates effective 15 Sep 93

EFFECTIVE 27 APR 95

| | | |
|---------|------------------|------------|
| Rate 3A | Customer Charge: | \$3,172.00 |
| | Demand KW: | \$7.02 |
| | On Peak KWH: | \$0.06196 |
| | Off Peak KWH: | \$0.05197 |
| | Refund Credit | 0 |
| | RKVA | \$1.02 |

1/31/96 Joe Oyba 748 called term. for O&M
info. Joe says H. Drum O&M is comprised of 3 items.
Labor, Equip. Rental & Supplies \$22,127 FY 1994

\$25,655 FY 1995

Just Chlorine \$ 5550 and is included in 1995

Development Authority of the North Country
Water Line
Schedule "A"

| Year | City Capital | DABC Capital | DABC Overhead | Combined Capital and Overhead | City O&M | DABC O&M | O&M /KGal. | Surf. Rod | Total /KGal. |
|------------------|--------------|--------------|---------------|-------------------------------|----------|----------|------------|-----------|--------------|
| 4/1/91 - 3/31/92 | 316,494 | 2,532,805 | 75,000 | 2,919,200 | 159,317 | 184,820 | 0.63 | 1.50 | 1.96 |
| 4/1/92 - 3/31/93 | 326,317 | 2,795,105 | 71,000 | 3,192,422 | 174,135 | 197,211 | 0.68 | 1.50 | 2.18 |
| 4/1/93 - 3/31/94 | 314,869 | 2,564,159 | 38,000 | 2,920,208 | 217,379 | 307,685 | 0.58 | 1.50 | 2.08 |
| 4/1/94 - 3/31/95 | 314,869 | 2,295,832 | 81,100 | 2,492,701 | 217,379 | 252,007 | 0.64 | 1.50 | 2.14 |
| 4/1/95 - 3/31/96 | 316,049 | 2,632,303 | 84,203 | 3,032,555 | 222,973 | 167,451 | 0.71 | 1.50 | 2.21 |
| 4/1/96 - 3/31/97 | 316,049 | 1,555,136 | 84,359 | 1,937,543 | 228,184 | 171,437 | 0.73 | 1.50 | 2.23 |
| 4/1/97 - 3/31/98 | 316,049 | 0 | 94,567 | 404,616 | 231,093 | 175,028 | 0.75 | 1.50 | 2.25 |
| 4/1/98 - 3/31/99 | 316,049 | 0 | 92,831 | 408,880 | 237,944 | 189,326 | 0.77 | 1.50 | 2.27 |
| 4/1/99 - 3/31/00 | 316,049 | 0 | 95,151 | 409,201 | 245,944 | 104,435 | 0.79 | 1.50 | 2.29 |
| 4/1/00 - 3/31/01 | 316,049 | 0 | 97,139 | 411,379 | 252,093 | 189,455 | 0.81 | 1.50 | 2.31 |
| 4/1/01 - 3/31/02 | 316,049 | 0 | 102,468 | 416,819 | 258,395 | 194,192 | 0.83 | 1.50 | 2.33 |
| 4/1/02 - 3/31/03 | 316,049 | 0 | 105,829 | 419,879 | 264,355 | 199,467 | 0.85 | 1.50 | 2.35 |
| 4/1/03 - 3/31/04 | 316,049 | 0 | 107,455 | 421,704 | 278,263 | 204,025 | 0.87 | 1.50 | 2.37 |
| 4/1/04 - 3/31/05 | 316,049 | 0 | 110,346 | 424,393 | 285,220 | 214,351 | 0.91 | 1.50 | 2.41 |
| 4/1/05 - 3/31/06 | 316,049 | 0 | 113,105 | 427,151 | 292,151 | 219,710 | 0.94 | 1.50 | 2.44 |
| 4/1/06 - 3/31/07 | 316,049 | 0 | 115,933 | 429,982 | 299,659 | 225,203 | 0.96 | 1.50 | 2.46 |
| 4/1/07 - 3/31/08 | 316,049 | 0 | 118,831 | 432,882 | 307,151 | 230,833 | 0.98 | 1.50 | 2.48 |
| 4/1/08 - 3/31/09 | 316,049 | 0 | 121,802 | 435,802 | 314,833 | 236,604 | 1.01 | 1.50 | 2.51 |
| 4/1/09 - 3/31/10 | 316,049 | 0 | 124,847 | 438,892 | 322,709 | 242,519 | 1.03 | 1.50 | 2.53 |
| 4/1/10 - 3/31/11 | 316,049 | 0 | 127,868 | 441,917 | 330,763 | 248,582 | 1.06 | 1.50 | 2.56 |
| 4/1/11 - 3/31/12 | 316,049 | 0 | 131,167 | 447,216 | 339,037 | 254,794 | 1.08 | 1.50 | 2.58 |
| 4/1/12 - 3/31/13 | 316,049 | 0 | 134,446 | 451,495 | 347,313 | 261,163 | 1.11 | 1.50 | 2.61 |

I have estimated the City Capital Rate, based on the issue date of the debt and current payments.

I have also estimated an annual increase of 2.5% on O&M and DABC Overhead.

THIS SCHEDULE HAS BEEN PREPARED BY SPECIAL REQUEST, IT MAY BE IN VARIANCE WITH CURRENT OR FUTURE SCHEDULE A'S

ECO #1 LCCA

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

| | | |
|---|----------------------|----------------------|
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 |
| ANALYSIS DATE: 05/10/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP |

1. INVESTMENT: ECO #1 - Repair Main Line, Service Line Leaks

| | | |
|--|------------------|----------------|
| A. CONSTRUCTION COST | = | \$2,332 |
| B. SIOH COST | (6.0% of 1A) = | \$140 |
| C. DESIGN COST | (6.0% of 1A) = | \$140 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$2,612 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$2,612 |

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS:

OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|------------------|--------------------------|------------------------|--------------------------|------------------------|---------------------------|
| A. ELECTRICAL | \$0.025 | 56,210 | \$1,405 | 13.86 | \$19,477 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. | | | | | |
| G. TOTAL | | 56,210 | \$1,405 | | -----> \$19,477 |

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

Unit Cost * 56,210 KGAL

| | | | | |
|---|---|----------|-------|-----------|
| 1 | DANC Variable Savings (\$0.67/KGAL) | \$37,773 | 13.47 | \$508,804 |
| 2 | Ft. Drum O&M Savings (\$0.028/KGAL) | \$1,574 | 13.47 | \$21,200 |
| 3 | Ft Drum Chemical Savings (\$0.031/KGAL) | \$1,743 | 13.47 | \$23,472 |
| 4 | Reservoir Savings (\$0.067/KGAL) | \$3,766 | 13.47 | \$50,729 |
| 5 | TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$44,856 | | \$604,205 |

B. NON-RECURRING (+/-)

| ITEM | SAVINGS (+) COST(-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/COST (4) |
|--|----------------------------|---------------------------|---------------------------------------|--------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. TOTAL | \$0 | | | \$0 |
| C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) | | | (3A5 + 3Bc4) = | \$604,205 |

| | | |
|--|-----------------------------------|-----------|
| 4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) | (2G3 + 3A + (3Bc1/Economic Life)) | \$46,261 |
| 5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) | (1G/4) = | 0.06 |
| 6. TOTAL NET DISCOUNTED SAVINGS | (2H5 + 3C) = | \$623,681 |
| 7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY) | (6/1G) = | 238.82 |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | SHEET | 1 | OF | 1 |
|-------------------------------------|------------------------------------|-----------------------------------|------|-----------------------|-------|---------------|---------|----------------|-------|------------------|---------|-----------|-------|
| AREA | | ACTIVITY | | LOCATION | | AMENDMENT NO. | | | | | | | |
| PROJECT TITLE | | DESCRIPTION | | CONTRACT NO. | | | | | | DACA01-94-D-0033 | | | |
| WATER CONSERVATION STUDY | | FIX MAIN LINE, SERVICE LINE LEAKS | | | | | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | | Unit Cost | Total |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | | |
| 1 | MAIN LINE LEAK REPAIR (1 LEAK) | | | | | | | | | | | | |
| 2 | EXCAVATION | CY | 24 | \$0.00 | \$0 | \$1.56 | \$37 | \$1.58 | \$38 | \$3 | \$75 | | |
| 3 | DEWATERING | DAY | 1 | \$0.00 | \$0 | \$71.00 | \$71 | \$8.05 | \$8 | \$79 | \$79 | | |
| 4 | PATCH PIPE LEAK | EA | 1 | \$200.00 | \$200 | \$130.00 | \$130 | \$0.00 | \$0 | \$330 | \$330 | | |
| 5 | CRUSHED ROCK BEDDING | CY | 4 | \$13.00 | \$52 | \$3.43 | \$14 | \$1.39 | \$6 | \$18 | \$71 | | |
| 6 | BACKFILL | CY | 20 | \$0.00 | \$0 | \$0.71 | \$14 | \$0.58 | \$12 | \$1 | \$26 | | |
| 7 | COMPACTION | CY | 24 | \$0.00 | \$0 | \$0.86 | \$21 | \$0.33 | \$8 | \$1 | \$29 | | |
| 8 | | | | | | | | | | | | | |
| 9 | SERVICE LINE LEAK REPAIR (2 LEAKS) | | | | | | | | | | | | |
| 10 | EXCAVATION | CY | 36 | \$0.00 | \$0 | \$1.56 | \$56 | \$1.58 | \$57 | \$3 | \$113 | | |
| 11 | DEWATERING | DAY | 1 | \$0.00 | \$0 | \$71.00 | \$71 | \$8.05 | \$8 | \$79 | \$79 | | |
| 12 | PATCH PIPE LEAK | EA | 2 | \$200.00 | \$400 | \$130.00 | \$260 | \$0.00 | \$0 | \$330 | \$660 | | |
| 13 | CRUSHED ROCK BEDDING | CY | 6 | \$13.00 | \$78 | \$3.43 | \$21 | \$1.39 | \$8 | \$18 | \$107 | | |
| 14 | BACKFILL | CY | 30 | \$0.00 | \$0 | \$0.71 | \$21 | \$0.58 | \$17 | \$1 | \$39 | | |
| 15 | COMPACTION | CY | 36 | \$0.00 | \$0 | \$0.86 | \$31 | \$0.33 | \$12 | \$1 | \$43 | | |
| 16 | | | | | | | | | | | | | |
| 17 | CONSTRUCTION SUBTOTAL | | | | \$730 | | \$747 | | \$174 | | \$1,651 | | |
| 18 | LOCATION FACTOR | % | | 81.80% | \$597 | 111.80% | \$835 | 100.00% | \$174 | | \$1,606 | | |
| 19 | OVERHEAD & BOND | % | 20 | | \$119 | | \$167 | | \$35 | | \$321 | | |
| 20 | SUBTOTAL | | | | \$717 | | \$1,002 | | \$208 | | \$1,927 | | |
| 21 | PROFIT | % | 10 | | \$72 | | \$100 | | \$21 | | \$193 | | |
| 22 | SUBTOTAL | | | | \$788 | | \$1,102 | | \$229 | | \$2,120 | | |
| 23 | CONTINGENCY | % | 10 | | \$79 | | \$110 | | \$23 | | \$212 | | |
| 24 | GRAND TOTAL | | | | \$867 | | \$1,213 | | \$252 | | \$2,332 | | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | DATE | | | | | | | |
| TCP | | | | E M C Engineers, Inc. | | 2/1/96 | | | | | | | |

ECO #2 LCCA

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

| | | |
|---|----------------------|----------------------|
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 |
| ANALYSIS DATE: 05/10/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP |

1 INVESTMENT: ECO #2 - Repair Valve Leaks

| | | |
|--|------------------|--------------|
| A. CONSTRUCTION COST | = | \$828 |
| B. SIOH COST | (6.0% of 1A) = | \$50 |
| C. DESIGN COST | (6.0% of 1A) = | \$50 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$927 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$927 |

2 ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS:

OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|------------------|--------------------------|------------------------|--------------------------|------------------------|---------------------------|
| A. ELECTRICAL | \$0.025 | 730 | \$18 | 13.86 | \$253 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. | | | | | |
| G. TOTAL | | 730 | \$18 | | -----> \$253 |

3 NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

Unit Cost * 730 KGAL

| | | | |
|---|-------|-------|---------|
| 1 DANC Variable Savings (\$0.67/KGAL) | \$491 | 13.47 | \$6,608 |
| 2 Ft. Drum O&M Savings (\$0.028/KGAL) | \$20 | 13.47 | \$275 |
| 3 Ft Drum Chemical Savings (\$0.031/KGAL) | \$23 | 13.47 | \$305 |
| 4 Reservoir Savings (\$0.067/KGAL) | \$49 | 13.47 | \$659 |
| 5 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$583 | | \$7,847 |

B. NON-RECURRING (+/-)

| ITEM | SAVINGS (+) COST(-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/COST (4) |
|----------|----------------------------|---------------------------|---------------------------------------|--------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. TOTAL | \$0 | | | \$0 |

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A5 + 3Bc4) = \$7,847

4 FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2G3 + 3A + (3Bc1/Economic Life)) \$601

5 SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 1.54

6 TOTAL NET DISCOUNTED SAVINGS (2H5 + 3C) = \$8,100

7 DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 8.74

(MUST HAVE SIR > 1.25 TO QUALIFY)

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | | | | | SHEET | 1 | OF | 1 |
|-------------------------------------|-------------------------|-----------------|------|-----------------------|-------|---------------|-------|----------------|-------|------------|-------|--|--|-------|---|----|---|
| AREA | | ACTIVITY | | LOCATION | | AMENDMENT NO. | | | | | | | | | | | |
| PROJECT TITLE | | DESCRIPTION | | CONTRACT NO. | | | | | | | | | | | | | |
| WATER CONSERVATION STUDY | | FIX VALVE LEAK | | DACA01-94-D-0033 | | | | | | | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | | | | | | | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | | | | | | |
| 1 | REPLACE LEAKING VALVE | | | | | | | | | | | | | | | | |
| 2 | EXCAVATION | CY | 18 | \$0.00 | \$0 | \$1.56 | \$28 | \$1.58 | \$28 | \$3.14 | \$57 | | | | | | |
| 3 | DEWATERING | DAY | 1 | \$0.00 | \$0 | \$71.00 | \$36 | \$8.05 | \$4 | \$79.05 | \$40 | | | | | | |
| 4 | VALVE DEMOLITION, TO 8" | EA | 1 | \$0.00 | \$0 | \$30.00 | \$30 | \$0.00 | \$0 | \$30.00 | \$30 | | | | | | |
| 5 | GATE VALVE, 04" | EA | 1 | \$270.00 | \$270 | \$108.00 | \$108 | \$0.00 | \$0 | \$378.00 | \$378 | | | | | | |
| 6 | CRUSHED ROCK BEDDING | CY | 3 | \$13.00 | \$39 | \$3.43 | \$10 | \$1.39 | \$4 | \$17.82 | \$53 | | | | | | |
| 7 | BACKFILL | CY | 15 | \$0.00 | \$0 | \$0.71 | \$11 | \$0.58 | \$9 | \$1.29 | \$19 | | | | | | |
| 8 | COMPACTION | CY | 18 | \$0.00 | \$0 | \$0.86 | \$15 | \$0.33 | \$6 | \$1.19 | \$21 | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | |
| 17 | CONSTRUCTION SUBTOTAL | | | | \$309 | | \$238 | | \$51 | | \$598 | | | | | | |
| 18 | LOCATION FACTOR | % | | 81.80% | \$253 | 111.80% | \$266 | 100.00% | \$51 | | \$570 | | | | | | |
| 19 | OVERHEAD & BOND | % | 20 | | \$51 | | \$53 | | \$10 | | \$114 | | | | | | |
| 20 | SUBTOTAL | | | | \$303 | | \$319 | | \$62 | | \$684 | | | | | | |
| 21 | PROFIT | % | 10 | | \$30 | | \$32 | | \$6 | | \$68 | | | | | | |
| 22 | SUBTOTAL | | | | \$334 | | \$351 | | \$68 | | \$753 | | | | | | |
| 23 | CONTINGENCY | % | 10 | | \$33 | | \$35 | | \$7 | | \$75 | | | | | | |
| 24 | GRAND TOTAL | | | | \$367 | | \$386 | | \$74 | | \$828 | | | | | | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | | | DATE | | | | | | | | | |
| TCP | | | | E M C Engineers, Inc. | | | | 2/1/96 | | | | | | | | | |

ECO #3 LCCA

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

| | | |
|---|----------------------|----------------------|
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 |
| ANALYSIS DATE: 05/10/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP |

1. INVESTMENT: ECO #3 - Repair Hydrant Leaks

| | | |
|--|------------------|-----------------|
| A. CONSTRUCTION COST | = | \$32,061 |
| B. SIOH COST | (6.0% of 1A) = | \$1,924 |
| C. DESIGN COST | (6.0% of 1A) = | \$1,924 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$35,908 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$35,908 |

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS:

OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|------------------|--------------------------|------------------------|--------------------------|------------------------|---------------------------|
| A. ELECTRICAL | \$0.025 | 4,745 | \$119 | 13.86 | \$1,644 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. | | | | | |
| G. TOTAL | | 4,745 | \$119 | | -----> \$1,644 |

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

Unit Cost * 4,745 KGAL

| | | | | |
|---|---|---------|-------|----------|
| 1 | DANC Variable Savings (\$0.67/KGAL) | \$3,189 | 13.47 | \$42,951 |
| 2 | Ft. Drum O&M Savings (\$0.028/KGAL) | \$133 | 13.47 | \$1,790 |
| 3 | Ft Drum Chemical Savings (\$0.031/KGAL) | \$147 | 13.47 | \$1,981 |
| 4 | Reservoir Savings (\$0.067/KGAL) | \$318 | 13.47 | \$4,282 |
| 5 | TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$3,787 | | \$51,004 |

B. NON-RECURRING (+/-)

| ITEM | SAVINGS (+) COST(-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/COST (4) |
|--|----------------------------|---------------------------|---------------------------------------|--------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. TOTAL | \$0 | | | \$0 |
| C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) | | | (3A5 + 3Bc4) = | \$51,004 |

| | | |
|--|-----------------------------------|----------|
| 4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) | (2G3 + 3A + (3Bc1/Economic Life)) | \$3,905 |
| 5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) | (1G/4) = | 9.20 |
| 6. TOTAL NET DISCOUNTED SAVINGS | (2H5 + 3C) = | \$52,648 |
| 7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY) | (6/1G) = | 1.47 |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | | | | SHEET | | 1 | OF | 1 |
|-------------------------------------|---------------------------|-------------------|------|-----------------------|----------|---------------|---------|----------------|---------|------------|----------|--|-------|--|---|----|---|
| AREA | | ACTIVITY | | LOCATION | | AMENDMENT NO. | | | | | | | | | | | |
| PROJECT TITLE | | DESCRIPTION | | CONTRACT NO. | | | | | | | | | | | | | |
| WATER CONSERVATION STUDY | | FIX HYDRANT LEAKS | | DACA01-94-D-0033 | | | | | | | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | | | | | | | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | | | | | | |
| 1 | HYDRANT REPLACEMENT | | | | | | | | | | | | | | | | |
| 2 | EXCAVATION | CY | 24 | \$0.00 | \$0 | \$1.56 | \$37 | \$1.58 | \$38 | \$3.14 | \$75 | | | | | | |
| 3 | HYDRANT DEMOLITION | EA | 1 | \$0.00 | \$0 | \$102.00 | \$102 | \$0.00 | \$0 | \$102.00 | \$102 | | | | | | |
| 4 | PIPE REMOVAL, TO 12" DIA. | LF | 10 | \$0.00 | \$0 | \$3.43 | \$34 | \$1.39 | \$14 | \$4.82 | \$48 | | | | | | |
| 5 | HYDRANT | EA | 1 | \$1,250.00 | \$1,250 | \$129.00 | \$129 | \$21.50 | \$22 | \$1,400.50 | \$1,401 | | | | | | |
| 6 | THRUST BLOCK | CY | 1 | \$81.50 | \$81 | \$110.10 | \$83 | \$0.00 | \$0 | \$191.60 | \$144 | | | | | | |
| 7 | BACKFILL | CY | 20 | \$0.00 | \$0 | \$0.71 | \$14 | \$0.58 | \$12 | \$1.29 | \$26 | | | | | | |
| 8 | CRUSHED ROCK BEDDING | CY | 4 | \$13.00 | \$52 | \$3.43 | \$14 | \$1.39 | \$6 | \$17.82 | \$71 | | | | | | |
| 9 | COMPACTION | CY | 24 | \$0.00 | \$0 | \$0.86 | \$21 | \$0.33 | \$8 | \$1.19 | \$29 | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | |
| 13 | TOTAL - ONE HYDRANT | | 1 | | \$1,363 | | \$434 | | \$98 | | \$1,895 | | | | | | |
| 14 | REPLACE 13 HYDRANTS | | 13 | | \$17,721 | | \$5,640 | | \$1,279 | | \$24,640 | | | | | | |
| 15 | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | |
| 17 | CONSTRUCTION SUBTOTAL | | | | \$17,721 | | \$5,640 | | \$1,279 | | \$24,640 | | | | | | |
| 18 | LOCATION FACTOR | % | | 81.80% | \$14,495 | 111.80% | \$6,306 | 100.00% | \$1,279 | | \$22,081 | | | | | | |
| 19 | OVERHEAD & BOND | % | 20 | | \$2,899 | | \$1,261 | | \$256 | | \$4,416 | | | | | | |
| 20 | SUBTOTAL | | | | \$17,395 | | \$7,567 | | \$1,535 | | \$26,497 | | | | | | |
| 21 | PROFIT | % | 10 | | \$1,739 | | \$757 | | \$154 | | \$2,650 | | | | | | |
| 22 | SUBTOTAL | | | | \$19,134 | | \$8,324 | | \$1,689 | | \$29,146 | | | | | | |
| 23 | CONTINGENCY | % | 10 | | \$1,913 | | \$832 | | \$169 | | \$2,915 | | | | | | |
| 24 | GRAND TOTAL | | | | \$21,047 | | \$9,156 | | \$1,857 | | \$32,061 | | | | | | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | | | DATE | | 2/10/96 | | | | | | | |
| TCP | | | | E M C Engineers, Inc. | | | | | | | | | | | | | |

ECO #4 LCCA

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

| | | |
|---|----------------------|----------------------|
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 |
| ANALYSIS DATE: 05/10/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP |

1. INVESTMENT: ECO #4 - Repair Discovered Leaks

| | | |
|--|------------------|-----------------|
| A. CONSTRUCTION COST | = | \$35,221 |
| B. SIOH COST | (6.0% of 1A) = | \$2,113 |
| C. DESIGN COST | (6.0% of 1A) = | \$2,113 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$39,447 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$39,447 |

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS:

OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|------------------|--------------------------|------------------------|--------------------------|------------------------|---------------------------|
| A. ELECTRICAL | \$0.025 | 61,685 | \$1,542 | 13.86 | \$21,374 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. | | | | | |
| G. TOTAL | | 61,685 | \$1,542 | | -----> \$21,374 |

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

Unit Cost * 61.685 KGAL

| | | | | |
|---|---|----------|-------|-----------|
| 1 | DANC Variable Savings (\$0.67/KGAL) | \$41,452 | 13.47 | \$558,363 |
| 2 | Ft. Drum O&M Savings (\$0.028/KGAL) | \$1,727 | 13.47 | \$23,265 |
| 3 | Ft Drum Chemical Savings (\$0.031/KGAL) | \$1,912 | 13.47 | \$25,758 |
| 4 | Reservoir Savings (\$0.067/KGAL) | \$4,133 | 13.47 | \$55,670 |
| 5 | TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$49,225 | | \$663,056 |

B. NON-RECURRING (+/-)

| ITEM | SAVINGS (+) COST(-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/COST (4) |
|----------|----------------------------|---------------------------|---------------------------------------|--------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. TOTAL | \$0 | | | \$0 |

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A5 + 3Bc4) = \$663,056

| | | |
|--|-----------------------------------|-----------|
| 4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) | (2G3 + 3A + (3Bc1/Economic Life)) | \$50,767 |
| 5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) | (1G/4) = | 0.78 |
| 6. TOTAL NET DISCOUNTED SAVINGS | (2H5 + 3C) = | \$684,430 |
| 7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY) | (6/1G) = | 17.35 |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | | |
|-------------------------------------|---------------------------|-----------------|---------------|-----------------------|---------------|------------|------------------|----------------|------------|------------|----------|
| AREA | | ACTIVITY | LOCATION | | SHEET | | 2 | | OF | 3 | |
| | | | FT. DRUM, NY | | AMENDMENT NO. | | | | | | |
| PROJECT TITLE | | | DESCRIPTION | | CONTRACT NO. | | DACA01-94-D-0033 | | | | |
| WATER CONSERVATION STUDY | | | FIX ALL LEAKS | | | | EQUIPMENT COST | | TOTAL COST | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | | |
| 1 | REPLACE LEAKING VALVE | | | | | | | | | | |
| 2 | EXCAVATION | CY | 18 | \$0.00 | \$0 | \$1.56 | \$28 | \$1.58 | \$28 | \$3.14 | \$57 |
| 3 | DEWATERING | DAY | 0.5 | \$0.00 | \$0 | \$71.00 | \$36 | \$8.05 | \$4 | \$79.05 | \$40 |
| 4 | VALVE DEMOLITION, TO 8" | EA | 1 | \$0.00 | \$0 | \$30.00 | \$30 | \$0.00 | \$0 | \$30.00 | \$30 |
| 5 | GATE VALVE, 04" | EA | 1 | \$270.00 | \$270 | \$108.00 | \$108 | \$0.00 | \$0 | \$378.00 | \$378 |
| 6 | CRUSHED ROCK BEDDING | CY | 3 | \$13.00 | \$39 | \$3.43 | \$10 | \$1.39 | \$4 | \$17.82 | \$53 |
| 7 | BACKFILL | CY | 15 | \$0.00 | \$0 | \$0.71 | \$11 | \$0.58 | \$9 | \$1.29 | \$19 |
| 8 | COMPACTION | CY | 18 | \$0.00 | \$0 | \$0.86 | \$15 | \$0.33 | \$6 | \$1.19 | \$21 |
| 9 | REPAIR VALVE LEAKS | | 1 | | \$309 | | \$238 | | \$51 | | \$598 |
| 10 | | | | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | HYDRANT REPLACEMENT | | | | | | | | | | |
| 13 | EXCAVATION | CY | 24 | \$0.00 | \$0 | \$1.56 | \$37 | \$1.58 | \$38 | \$3.14 | \$75 |
| 14 | HYDRANT DEMOLITION | EA | 1 | \$0.00 | \$0 | \$102.00 | \$102 | \$0.00 | \$0 | \$102.00 | \$102 |
| 15 | PIPE REMOVAL, TO 12" DIA. | LF | 10 | \$0.00 | \$0 | \$3.43 | \$34 | \$1.39 | \$14 | \$4.82 | \$48 |
| 16 | HYDRANT | EA | 1 | \$1,250.00 | \$1,250 | \$129.00 | \$129 | \$21.50 | \$22 | \$1,401.50 | \$1,401 |
| 17 | THRUST BLOCK | CY | 1 | \$81.50 | \$61 | \$110.10 | \$83 | \$0.00 | \$0 | \$191.60 | \$144 |
| 18 | BACKFILL | CY | 20 | \$0.00 | \$0 | \$0.71 | \$14 | \$0.58 | \$12 | \$1.29 | \$26 |
| 19 | CRUSHED ROCK BEDDING | CY | 4 | \$13.00 | \$52 | \$3.43 | \$14 | \$1.39 | \$6 | \$17.82 | \$71 |
| 20 | COMPACTION | CY | 24 | \$0.00 | \$0 | \$0.86 | \$21 | \$0.33 | \$8 | \$1.19 | \$29 |
| 21 | TOTAL - ONE HYDRANT | | 1 | | \$1,363 | | \$434 | | \$98 | | \$1,895 |
| 22 | REPLACE 13 HYDRANTS | | 13 | | \$17,721 | | \$5,640 | | \$1,279 | | \$24,640 |
| 23 | | | | | | | | | | | |
| 24 | GRAND TOTAL | | | | \$17,721 | | \$5,640 | | \$1,279 | | \$24,640 |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | | DATE | | | | |
| TCP | | | | E M C Engineers, Inc. | | | 2/10/96 | | | | |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | |
|-------------------------------------|--------------------------|-----------------|---------------|-----------------------|---------------|------------|------------------|----------------|---------|------------|
| AREA | | ACTIVITY | LOCATION | | SHEET | | 3 OF 3 | | | |
| | | | FT. DRUM, NY | | AMENDMENT NO. | | | | | |
| PROJECT TITLE | | | DESCRIPTION | | CONTRACT NO. | | DACA01-94-D-0033 | | | |
| WATER CONSERVATION STUDY | | | FIX ALL LEAKS | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | |
| 1 | | | | | | | | | | |
| 2 | MAIN LINE LEAK REPAIR | EA | 1 | | \$252 | | \$287 | | \$71 | \$610 |
| 3 | SERVICE LINE LEAK REPAIR | EA | 2 | \$239 | \$478 | \$230 | \$460 | \$51 | \$103 | \$1,041 |
| 4 | REPLACE LEAKING VALVE | EA | 1 | | \$309 | | \$238 | | \$51 | \$598 |
| 5 | HYDRANT REPLACEMENT | EA | 13 | \$1,363 | \$17,721 | \$434 | \$5,640 | \$98 | \$1,279 | \$24,640 |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | CONSTRUCTION SUBTOTAL | | | | \$18,760 | | \$6,625 | | \$1,504 | \$26,889 |
| 18 | LOCATION FACTOR | % | | 81.80% | \$15,345 | 111.80% | \$7,407 | 100.00% | \$1,504 | \$24,257 |
| 19 | OVERHEAD & BOND | % | 20 | | \$3,069 | | \$1,481 | | \$301 | \$4,851 |
| 20 | SUBTOTAL | | | | \$18,414 | | \$8,889 | | \$1,805 | \$29,108 |
| 21 | PROFIT | % | 10 | | \$1,841 | | \$889 | | \$180 | \$2,911 |
| 22 | SUBTOTAL | | | | \$20,256 | | \$9,777 | | \$1,985 | \$32,019 |
| 23 | CONTINGENCY | % | 10 | | \$2,026 | | \$978 | | \$199 | \$3,202 |
| 24 | GRAND TOTAL | | | | \$22,281 | | \$10,755 | | \$2,184 | \$35,221 |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | | DATE | | | |
| TCP | | | | E M C Engineers, Inc. | | | 2/10/96 | | | |

ECO #5 LCCA

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

| | | |
|---|----------------------|----------------------|
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 |
| ANALYSIS DATE: 05/13/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP |

1. INVESTMENT: ECO #5 - Implement Leak Detection Program

| | | |
|--|------------------|-----------------|
| A. CONSTRUCTION COST | = | \$26,000 |
| B. SIOH COST | (6.0% of 1A) = | \$1,560 |
| C. DESIGN COST | (6.0% of 1A) = | \$1,560 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$29,120 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$29,120 |

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS:

OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|---------------|-----------------------|---------------------|-----------------------|---------------------|------------------------|
| A. ELECTRICAL | \$0.025 | 62,621 | \$1,566 | 13.86 | \$21,698 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. | | 0 | \$0 | | \$0 |
| G. TOTAL | | 62,621 | \$1,566 | | -----> \$21,698 |

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-) Unit Cost * 62,621 KGAL

| | | | |
|---|------------|-------|-------------|
| 1 DANC Variable Savings (\$0.67/KGAL) | \$42,081 | 13.47 | \$566,832 |
| 2 Ft. Drum O&M Savings (\$0.028/KGAL) | \$1,753 | 13.47 | \$23,618 |
| 3 Ft Drum Chemical Savings (\$0.031/KGAL) | \$1,941 | 13.47 | \$26,148 |
| 4 Reservoir Savings (\$0.067/KGAL) | \$4,196 | 13.47 | \$56,514 |
| 5 Annual Leak Detection Cost | (\$29,120) | 13.47 | (\$392,246) |
| 6 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$20,851 | | \$280,866 |

B. NON-RECURRING (+/-)

| ITEM | SAVINGS (+) COST (-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/ COST (4) |
|----------|-----------------------------|---------------------------|---------------------------------------|------------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. | | | | \$0 |
| d. TOTAL | \$0 | | | \$0 |

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A6 + 3Bd4) = \$280,866

- | | | |
|--|-----------------------------------|-----------|
| 4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) | (2H3 + 3A + (3Bd1/Economic Life)) | \$22,417 |
| 5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) | (1G/4) = | 1.30 |
| 6. TOTAL NET DISCOUNTED SAVINGS | (2H5 + 3C) = | \$302,564 |
| 7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY) | (6/1G) = | 10.39 |

WATER AUDIT WORKSHEET

Total Amount of Water Available (Flow into system minus storage):

| <u>Gallons/Year</u> | <u>Gallons/Min.</u> | <u>Percentage</u> |
|---------------------|---------------------|-------------------|
| 709,300,653 | 1,350 | 100.00% |

Water Uses (From annual average data from 1994-1995 provided by Ft. Drum):

| | | | | |
|----------------------------------|---|------------------|----------|--------------|
| Domestic Water Consumption: | = | 596,420,000 | 1,135 | 84.09% |
| Metered Water Users: | = | 17,308,500 | 33 | 2.44% |
| Fire Hydrants (Fire Protection): | = | 576,000 | 1 | 0.08% |
| Fire Hydrants (Maintenance): | = | 528,000 | 1 | 0.07% |
| Once-through Cooling Units: | = | 6,450,000 | 12 | 0.91% |
| Landscaping: | = | <u>4,524,000</u> | <u>9</u> | <u>0.64%</u> |
| Total Identified Water Consumed: | | 625,806,500 | 1,191 | 88.23% |

Potential Water System Losses:

| | | |
|------------|-----|--------|
| 83,494,153 | 159 | 11.77% |
|------------|-----|--------|

Recoverable Leakage (AWWA Manual 36 estimates 75% is recoverable):

| | | |
|------------|-----|-------|
| 62,620,615 | 119 | 8.83% |
|------------|-----|-------|

Cost of Water Supply (per 1000 gallons):

\$0.82

One Year Benefit from Recoverable Leakage:

\$51,349

Total Cost of Leak Detection Program: \$200 / mile x 130 miles

\$26,000

Benefit to Cost Ratio:

1.97

Simple Payback (years):

0.51

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JOB Ft. Drum Water Study 1406-012
 SHEET NO. 1 OF 7
 CALCULATED BY TCP DATE 2/7/96
 CHECKED BY _____ DATE _____
 SCALE Water Audit

Water Audit - Ft. Drum

Water audit is based on procedures outlined by American Water Works Association (AWWA) Manual 36, "Water Audits and Leak Detection." Total water usage is estimated by combining those usages which are metered, or can be reasonably estimated, and add water usage for unrecoverable leakage.

Telemetry data does provide any average flow usage, which is based on:

$$\text{Flow} = (\text{All well} + \text{DANC incoming flow}) - (\text{All tank} + \text{Storage increases})$$

Flow = 724,511,133 gal/year (Avg. value over 2 years)
 Datalog #1

Telemetry data from DANC and from the wells, Datalog #3:

| | <u>DANC</u> | <u>Wells</u> | <u>Total</u> |
|-------------------|-------------|--------------|------------------|
| Aug-93 to July-94 | 528,571,812 | 183,677,992 | 712,249,804 |
| Aug-94 to July-95 | 529,463,573 | 176,887,928 | 706,351,501 |
| Average | 529,017,693 | 180,282,960 | 709,300,653 gpl. |

* Use Datalog #3 data, which is slightly more accurate because it calculates specific areas at 5 min. intervals, not 15 min.

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JOB Ft. Drum Water Study 1406-012
SHEET NO. 2 OF 7
CALCULATED BY TCP DATE 2-8-96
CHECKED BY _____ DATE _____
SCALE Water Consumption Figures

Population / Water Consumption - Ft. Drum

Source: "Total Army Quality Self Assessment, 1995" Ft. Drum

- No. of Installation Bldgs: 2,159 (total)
- No. of Temporary / Semi-Permanent: 930
- No. of Permanent Bldgs: 1,229

- Units of Family Housing: 4,272 units
- Family Housing On-Post: 2,272 "
- " " Off-Post: 2,000 "
(in 13 off-post locations)

- Active Duty Military: 9,951 persons
- Family Members: 13,965 "
- Military Retirees: 6,300 "
- Civilian Employees: 1,865 "
- Reserve Component Troops: 43,000 "
(Train annually or weekends)

According to Army Technical Manual TM-5-813-1 "Water Supply Sources and General Considerations", the design allowances for water consumption is:

- Residents = 150 gal/person/day
- Non-Residents = 50 gal/person/day

PRINCIPAL CUSTOMERS

The garrison's principle customers include: the 10th Mountain Division (Light Infantry); U.S. Army Medical Department Activity; U.S. Army Dental Activity; Defense Finance and Accounting Office; American Red Cross; Defense Commissary Agency; Army and Air Force Exchange Service; Defense Logistics Agency; Defense Investigative Service; Defense Printing Service; Defense Reutilization and Marketing Office; Army Reserve Command Equipment Concentration Site; Resident Agency Third Military Police Group; New York District Army Corps of Engineering; Non-Commissioned Officers Academy; New York Army National Guard Maintenance Assistance Teams Support; Readiness Group Drum; Trial Defense Service; 20th Air Support Operations Squadron; New Jersey Army National Guard Maintenance Assistance Teams Support; 95th Maintenance Company ATST-10 Test, Measurement, Diagnostic, Equipment Support; 145th Maintenance Company; 174th Fighter Wing, Detachment. 1 New York Army National Guard; 10th Military Police Battalion (Provisional); Federal Employee Unions; soldier's families; military retirees; Fort Indiantown Gap and Charles E. Kelly Support Facility in Pennsylvania; general public and local civilian communities; higher headquarters; Army Reserve components including 35 Reserve Centers owned or lease by Fort Drum around the state, and government contractors.

Fort Drum has approximately 9,951 active duty military, 13,965 family members, and 8,300 military retirees supported through installation products and services

Of the active duty military: 51.9% are married; 91.9% are male; 14.8% are under age 21, 56.2% are between the ages of 21-30 ; 68.5% are Caucasian, 22.8% Afro-American, 1.2% Asian, 0.4% American Indian, 6.9% Other; 47.8% of the children of military families are age 5 or under.

EMPLOYEE BASE

Fort Drum has 1,856 Department of Army civilian employees, of which 85.5% are appropriated funded positions and 14.5% non-appropriated funded. Approximately 93% of Fort Drum's employees have earned either a high school diploma, attended college and earned a degree (Associate, Bachelor, Masters or Doctorate) or have had some

level of college training. The total workforce is 61% male, 39% female. In the General Schedule grade structure, 20% are GS-04 and under, 48% GS-05 to GS-08, 26% between GS-09-GS-11, and 6% between GS-12-GS-14. The average age of a typical worker is 44 years.

KEY CUSTOMER REQUIREMENTS

Timeliness, with respect to customer requirements, is critical to customer satisfaction. Our willingness to help customers in a prompt and timely manner is one of the performance factors used to judge the quality of our service.

Reliability, which is the customer's perception of our ability to provide the promised service dependably and accurately is another performance factor used to gauge customer satisfaction. Do it right the first time, every time, is our key to success.

Cost Effectiveness is a quality that must be managed and monitored closely in today's climate of dwindling resources.

Legal and Regulatory Compliance is essential to everyone's physical well-being. As stewards of the environment, we are obliged to maintain a safe and secure environment for our military, civilians, family members and local civilian communities.

LOCATION AND SIZE

Fort Drum is located in northern New York State between Lake Ontario and the Adirondack Mountains, approximately 25 miles southeast of the Thousand Islands of the St. Lawrence River, and the United States-Canadian border.

The largest city adjacent to Fort Drum is the city of Watertown, population 30,000 located approximately 10 miles southwest of the post. The next largest city is Syracuse, population 163,860, approximately 80 miles to the south.

The installation contains 107,265 acres; is rectangular in shape and oriented in a northeast / southwest linear alignment, approximately 10 miles wide by 21 miles long. The cantonment area contains 11,369 acres of land. The remaining

95, 896 acres, which are used for training, includes a 24,007 acre main impact area. There are 2,159 buildings on the installation of which 930 are temporary and semi-permanent World War II vintage. The remaining 1,229 permanent facilities were constructed between 1975 and 1994. The majority of the buildings were constructed during the 1985 - 1992 time frame when a new cantonment area was built for the stationing of the 10th Mountain Division (Light Infantry).

Fort Drum has 4,272 units of family housing. Of these, 2,272 are on-post while 2,000 units are in Army Community Housing areas located in 13 separate off-post locations in three counties, up to 30 miles from the main cantonment area.

Fort Drum's geographic location places it in a four-season environment that allows soldiers to train in all types of weather. Winter snows generally average over 100 inches while summer temperatures rise into the 80 - 90 degree Fahrenheit range. The beauty of the area and recreational opportunities make tourism one of the major businesses. Besides being home to the 10th Mountain Division (Light Infantry), Fort Drum also supports approximately 43,000 Reserve Component troops who train on the installation annually or on weekends.

MAJOR EQUIPMENT, FACILITIES, TECHNOLOGY

In addition to Fort Drum's own large land area, it is the support installation for both Fort Indiantown Gap and Charles E. Kelly Support Facility, located in southeastern and western Pennsylvania, respectively.

The installation has an active Army Airfield that was expanded in the early 1990's to support the aviation units of the 10th Mountain Division. The new heliport, dedicated in May 1992, contains four aviation maintenance hangars, a control tower and operations building, fire crash rescue station, fuel storage facilities, hot refuel points, and parking apron for approximately 120 helicopters.

Additionally, the United States Air Force is in the process of developing plans to extend our primary runway to 10,000 feet, allowing Fort Drum troops to deploy in C141 aircraft directly from the installation instead of from Griffiss Airforce Base, approximately 90 miles to our southwest.

Fort Drum has 29 fixed training ranges that support the training needs of both armor and infantry units, an ammunition supply point, and rail -loading facilities. A Military Operations in Urban Terrain facility, opened this year and is the newest training facility on Fort Drum. Between 1985 and 1991 Fort Drum was the site of the largest peace time military construction expansion in the continental United States since World War II. A recent six-year \$1.3 billion investment resulted in the construction of an entire new cantonment area along with an improved airfield to support the stationing of the 10th Mountain Division (Light Infantry), producing the most modern military installation in the world.

Many of the facilities constructed are unique to the Army and Fort Drum. As an example, the Information Management Facility is the only structure of its kind in the Army. It is the hub of all voice and data networks on the installation. Nine remote switching offices located throughout the post are linked to this facility by underground fiber optics. The Safety and Law Enforcement building is the most modern military police station in the Army. It contains a \$10 million intrusion detection system that monitors arms rooms and ammunition storage for the entire post from a single location. All brigade maintenance facilities were designed to accommodate the M1 Abrams Tank. A new state-of-the-art central vehicle wash facility that includes both an indoor winter wash and outdoor facilities for tracked and wheeled vehicles opened this year. In addition, a new environmental-safe state-of-the-art consolidated refueling point was opened this spring replacing World War II fuel dispensing facilities. A new consolidated general purpose warehouse is nearing completion, as is a community club for both officers and enlisted service members.

SUPPLIERS OF GOODS AND SERVICES

The civilian commercial sector supplies many goods and services to the installation. A state agency, Development Authority of the North Country, was formed during the expansion of Fort Drum to assist with the disposal of solid waste, treatment of sewage, and to supplement potable water needs throughout the area.

In addition, local utilities provide telephone and power distribution support. Other support services provided by the public sector include snow

CHAPTER 1

GENERAL

AA

1-1. Purpose

This manual provides guidance for selecting water sources, in determining water requirements for Army and Air Force installations including special projects, and for developing suitable sources of supply from ground or surface sources.

1-2. Scope

This manual is applicable in selection of all water sources and in planning or performing construction of supply systems. Other manuals in this series are:

TM 5-813-3/AFM 88-10, Vol. 3-Water Treatment

TM 5-813-4/AFM 88-10, Vol. 4-Water Storage

TM 5-813-5/AFM 88-10, Vol. 5-Water Distribution

TM 5-813-6/AFM 88-10, Chap. 6-Water Supply for Fire Protection

TM 5-813-7/AFM 88-10, Vol. 7-Water Supply for Special Projects

TB MED-229-Sanitary Control and Surveillance of Water Supplies at Fixed and Field Installations

AFR 161-44-Management of the Drinking Water Surveillance Program

1-3. Definitions

a. General definitions. The following definitions, relating to all water supplies, are established.

(1) Water works. All construction (structures, pipe, equipment) required for the collection, transportation, pumping, treatment, storage and distribution of water.

(2) Supply works. Dams, impounding reservoirs, intake structures, pumping stations, wells and all other construction required for the development of a water supply source.

(3) Supplyline. The pipeline from the supply source to the treatment works or distribution system.

(4) Treatment works. All basins, filters, buildings and equipment for the conditioning of water to render it acceptable for a specific use.

(5) Distribution system. A system of pipes and appurtenances by which water is provided for domestic and industrial use and firefighting.

(6) Feeder mains. The principal pipelines of a distribution system.

(7) Distribution mains. The pipelines that constitute the distribution system.

(8) Service line. The pipeline extending from the distribution main to building served.

(9) Effective population. This includes resident military and civilian personnel and dependents plus an allowance for nonresident personnel, derived as follows: The design allowance for nonresidents is 50 gal/person/day whereas that for residents is 150 gal/person/day. Therefore, an "effective-population" value can be obtained by adding one-third of the population figure for nonresidents to the figure for residents.

$$\begin{array}{rcl} & \text{Nonresident Population} & \\ \text{Effective Population} = & \text{AAAAAAAAAAAAAAAAAAAA} & \\ & 3 & \\ & + \text{Resident Population} & \end{array}$$

(10) Capacity factor. The multiplier which is applied to the effective population figure to provide an allowance for reasonable population increase, variations in water demand, uncertainties as to actual water requirements, and for unusual peak demands whose magnitude cannot be accurately estimated in advance. The Capacity Factor varies inversely with the magnitude of the population in the water service area.

(11) Design population. The population figure obtained by multiplying the effective-population figure by the appropriate capacity factor.

$$\text{Design Population} = [\text{Effective Population}] \times [\text{Capacity Factor}]$$

(12) Required daily demand. The total daily water requirement. Its value is obtained by multiplying the design population by the appropriate per capita domestic water allowance and adding to this quantity any special industrial, aircraft-wash, irrigation, air-conditioning, or other demands. Other demands include the amount necessary to replenish in 48 hours the storage required for fire protection and normal

CHAPTER 2

WATER REQUIREMENTS

AA

2-1. Domestic requirements

The per-capita allowances, given in table 2-1, will be used in determining domestic water requirements. These allowances do NOT include special purpose water uses, such as industrial, aircraft-wash, air-conditioning, irrigation or extra water demands at desert stations.

2-2. Fire-flow requirements

The system must be capable of supplying the fire flow specified plus any other demand that cannot be reduced during the fire period at the required residual pressure and for the required duration. The requirements of each system must be analyzed to determine whether the capacity of the system is fixed by the domestic requirements, by the fire demands, or by a combination of both. Where fire-flow demands are relatively high, or required for long duration, and population and/or industrial use is relatively low, the total required capacity will be determined by the prevailing fire demand. In some exceptional cases, this may warrant consideration of a special water system for fire purposes, separate, in part or in whole, from the domestic system. However, such separate systems will be appropriate only under exceptional circumstances and, in general, are to be avoided.

2-3. Irrigation

The allowances indicated in table 2-1 include water for limited watering or planted and grassed areas. However, these allowances do not include major lawn or other irrigation uses. Lawn irrigation provisions for facilities, such as family quarters and temporary structures, in all regions will be limited to hose bibbs on the outside of buildings and risers for hose connections. Where substantial irrigation is deemed necessary and water is available, underground sprinkler systems may be considered. In general, such systems should receive consideration only in arid or semiarid areas where rainfall is less than about 25 inches annually. For Army Projects, all proposed installations require specific authorization from HQDA (DAEN-ECE-G), WASH, DC 20314. For Air Force projects, refer to AFM 88-15 and AFM 88-10, Vol. 4. Each project proposed must include thorough justification, detailed plans of connection to water source, estimated cost and a statement as to the adequacy of the water supply to support the irrigation system. The use of underground sprinkler systems will be limited as follows: Air Force Projects--Areas adjacent to hospitals, chapels, clubs, headquarters and administration buildings, and Army Projects--Areas adjacent to hospitals, chapels, clubs, headquarters and administration buildings, athletic fields, parade grounds, EM barracks, BOQ's, and other areas involving improved vegetative plantings which require frequent irrigation to maintain satisfactory growth.

a. Backflow prevention. Backflow prevention devices, such as a vacuum breaker or an air gap, will be provided for all irrigation systems connected to potable water systems. Installation of backflow preventers will be in accordance with AFM 88-21, Operation and Maintenance of Cross Connection Control and Backflow Prevention Systems (for Air Force facilities) and the National Association of Plumbing-Heating-Cooling Contractors (NAPHCC) "National Standard Plumbing Code," (see app. A for references). Single or multiple check valves are not acceptable backflow prevention devices and will not be used. Direct cross connections between potable and nonpotable water systems will not be permitted under any circumstances.

b. Use of treated wastewater. Effluent from wastewater treatment plants can be used for irrigation when authorized. Only treated effluent having a detectable chlorine residual at the most remote discharge point will be used. Where state or local regulations require additional treatment for irrigation, such requirement will be complied with. The effluent irrigation system must be physically separated from any distribution systems carrying potable water. A detailed plan will be provided showing the location of the effluent irrigation system in relation to the potable water distribution system and buildings. Provision will be made either for locking the sprinkler irrigation control valves or removing the valve handles so that only authorized personnel can operate the system. In

addition, readily identifiable "nonpotable" or "contaminated" notices, markings or codings for wastewater conveyance facilities and appurtenances will be provided. Another possibility for reuse of treated effluent is for industrial operations where substantial volumes of water for washing or cooling purposes are required. For any reuse situation, great care must be exercised to avoid direct cross connections between the reclaimed water system and the potable water system.

c. Review of effluent irrigation projects. Concept plans for proposed irrigation projects using wastewater treatment plant effluent will be reviewed by the engineer and surgeon at Installation Command level and the Air Force Major Command, as appropriate. EM 1110-1-501 will serve as the basic criteria for such projects, as amended by requirements herein. This publication is available through HQ USACE publications channels (see App. A, References). Such projects will only be authorized after approval by HQDA (DAEN-ECE-G), WASH DC 20314 and HQDA (DASG-PSP-E), WASH DC 20310 for Army projects and by HQUSAF (HQ USAF/LEEEU), WASH DC 20332 and The Surgeon General, (HQ AFMSC/SGPA), Brooks AFB, TX 78235 for Air Force projects.

Table 2-1. Domestic Water Allowances for Army and Air Force Projects.[1]

| | Gallons/Capita/Day[2] | |
|---|--|----------------------|
| | Permanent Construction | Field Training Camps |
| USAF Bases and Air Force Stations | 150[3] | -- |
| Armored/Mech. Divisions | 150 | 75 |
| Camps and Forts | 150[4] | 50 |
| POW and Internment Camps | -- | 50[4] |
| Hospital Units[5] | 600/Bed | 400/Bed |
| Hotel[6] | 70 | -- |
| Depot, Industrial, Plant and Similar Projects | 50 gal/employee/8-hr shift; 150 gal/capita/day for resident personnel | |

AAAAAAAAAAAAA

Notes:

- [1] For Aircraft Control and Warning Stations, National Guard Stations, Guided Missile Stations, and similar projects, use TM 5-813-7/AFM 88-10, Volume 7 for water supply for special projects.
- [2] The allowances given in this table include water used for laundries to serve resident personnel, washing vehicles, limited watering of planted and grassed areas, and similar uses. The allowances tabulated do NOT include special industrial or irrigation uses. The per capita allowance for nonresidents will be one-third that allowed for residents.
- [3] An allowance of 150 gal/capita/day will also be used for USAF semi-permanent construction.
- [4] For populations under 300, 50 gal capita/day will be used for base camps and 25 gal/capita/day for branch camps.
- [5] Includes hotels and similar facilities converted to hospital use.
- [6] Includes similar facilities converted for troop housing.

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JOB Ft. Drum Water Study 1406-002
 SHEET NO. 3 OF 7
 CALCULATED BY TCP DATE 2/2/96
 CHECKED BY _____ DATE _____
 SCALE Water Audit

Population/Water Consumption (cont.)

Because of limited demographical data, assume:

- Number of military personnel and family members living on-post @ 150 gpd/person:
 (Number of Family On-Post Housing) (4 person/housing unit)
 $= (2272 \text{ units})(4 \text{ persons/unit})(150 \text{ gpd/person})$
 $= (1,363,200 \text{ gal/day})(350 \text{ days/year})^*$
 $= \boxed{477,120,000 \text{ gal/year}}$ Military, family on-post

* Assume military personnel spend at least two weeks/year off-post, including their family members, on leave/holiday

- Number of civilian employees:
 $= (11865 \text{ people})(50 \text{ gpd/person})(250 \text{ days/year})^{**}$
 $= \boxed{23,312,500 \text{ gal/year}}$ Civilian employees

- Number of military personnel living off-post: (@ 50 gpd)
 $= (\text{Total number of military personnel} - \text{Number living on-post})$
 $= (9,951 - 2,272 \text{ people})(50 \text{ gpd/person})(250 \text{ days/year})^{**}$
 $= \boxed{95,987,500 \text{ gal/year}}$

** Note: Assume off-post residents work on post:
 (5 days/week)(52 weeks/year) - 10 days holiday = 250 days/yr.

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JOB Ft. Drum Water Study 1406-012
 SHEET NO. 4 OF 7
 CALCULATED BY TOP DATE 2/8/96
 CHECKED BY _____ DATE _____
 SCALE Water Audit

Population/ Water Consumption (cont)

Estimated domestic water usage =

- Military personnel, family members on-post:
 = 477,120,000 gal/yr.
 - Civilian employees: = 23,312,500 gal/yr.
 - Military personnel off-post = 95,987,500 gal/yr.
- 596,420,000 gal/yr.

- Assume military retirees, off-post family members and reserve troops do not significantly affect total domestic water consumption.

Metered Water Usage - Ft. Drum

According to data provided by Ft. Drum, meters are read for water usage in 15 buildings on post, including:

| <u>Building</u> | <u>Avg. Water Use (2 yrs.)</u> | |
|-----------------|--------------------------------|------|
| PX | 1663 | Kgal |
| Burger King | 382.5 | " |
| Spinners | 547.5 | " |
| Old PX | 578.5 | " |
| Mini Mall | 3416.5 | " |
| Pennants | 502 | " |
| Gas Station | 54 | " |
| Commissary | 802.5 | " |
| Inn @ Ft. Drum | 5232.5 | " |

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JOB Fl. Drain Water Study 1406-012
SHEET NO. 5 OF 7
CALCULATED BY TCP DATE 2/8/96
CHECKED BY _____ DATE _____
SCALE Water Audit

Metered Water Usage (cont.)

| <u>Bldg.</u> | <u>Avg. Water Use (1994-1995)</u> |
|--------------|-----------------------------------|
| NJNG | 332.5 Kgal |
| NJNG | 468.5 " |
| Credit Union | 111 " |
| J.A. Jones | 3,152.5 " |
| Key Bank | 65 " |

Total: 17,308,500 gal/year

Fire Hydrants

- Assume hydrants are used for two purposes: Fire protection and maintenance (improving circulation in stagnated lines).
- Assume hydrants have flow capacity of 1200 gpm (hydrant test data)

Fire Protection:

- Assume hydrants are used 8 hrs/year for fire protection:

$$\text{Flow} = (8 \text{ hrs/yr})(60 \text{ min/hr})(1,200 \text{ gpm}) = 576,000 \text{ gal/year}$$

Maintenance:

- Assume hydrants are opened twice a week for 22 weeks (which includes May through September)
- Assume hydrants are opened for 10 min. at a time for maintenance purposes.
- Assume hydrant flow = 1,200 gpm

$$\text{Flow} = (2/\text{week})(22 \text{ wks/yr})(10 \text{ min.})(1200 \text{ gpm})$$

$$\text{Flow} = 528,000 \text{ gal/year}$$

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JOB Ft. Drum Water Study 1406-012
SHEET NO. 6 OF 7
CALCULATED BY TOP DATE 2/8/96
CHECKED BY _____ DATE _____
SCALE Water Audit

Water Consumed - Once Through Cooling Units

- Water is used for cooling in the following units, according to Ft. Drum HVAC Shop:

- 3 ton unit = $(7.5 \text{ gal/min})(60 \text{ min/hr})(1,000 \text{ hrs/yr}) = 450,000 \text{ gal/yr}$
- 10 ton unit = $(25 \text{ gal/min})(60 \text{ min/hr})(1,000 \text{ hrs/yr}) = 1,500,000 \text{ gal/yr}$
- 4 Walk-in coolers = $4(7.5 \text{ gal/min})(60 \text{ min/hr})(2,000 \text{ hrs/yr}) = 4,500,000 \text{ gal/yr}$

Total usage = 6,450,000 gal/yr.

Landscaping/Irrigation

- Water is consumed on new post for landscaping.
- Assume any water used for landscaping of housing units is accounted for under domestic water consumption.
- Assume remaining water use for landscaping occurs at headquarters bldgs, parade field, and football fields.
- Assume these areas are irrigated every other day from May through September (5 months/year), according to information from Ft. Drum. Assume approx. 80 days/year.
- Assume for a football field (approx 150' x 300') and a sprinkler head with a throw of 50 feet, approximately 28 sprinkler heads are required. Assume the parade grounds are about twice the area and 49 heads are required.
- Assume only 4 sprinkler heads are utilized at one time.

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 SHEET NO. 7 OF 7
 CALCULATED BY TCP DATE 2/8/96
 CHECKED BY _____ DATE _____
 SCALE Water Audit

Landscaping / Irrigation

- Assume a flow rate of 10 gpm for sprinklers serving the football fields and parade field. Assume a flow of 5 gpm per head for sprinklers serving headquarters bldgs.
- Assume sprinkler heads are operated in 1 hour cycles in all areas.

Football / Parade Fields

$$\text{Flow} = \left[\frac{(28+49) \text{ heads}}{4 \text{ heads/cycle/day}} \right] \left[60 \frac{\text{min}}{\text{cycle}} \right] \left[10 \frac{\text{gal}}{\text{min}} \right] \left[80 \frac{\text{days}}{\text{year}} \right]$$

$$\text{Flow} = (19.25 \text{ cycles/day}) (60 \text{ min/cycle}) (10 \text{ gpm}) (80 \text{ days/yr})$$

$$\boxed{\text{Flow} = 924,000 \text{ gal/year}}$$

Headquarters Bldgs.

- Assume 5 buildings with significant irrigation.
- Assume each building has ~~5~~ 5 zones, with 6 heads/zone
- Assume smaller sprinkler heads = 5 gpm/head
- Assume irrigation every other day @ 60 min per zone.

$$\text{Flow} = (5 \text{ bldgs.}) (5 \text{ zones/bldg}) (6 \text{ heads/zone}) (5 \text{ gpm/head}) \left(80 \frac{\text{days}}{\text{yr}} \right) \left(60 \frac{\text{min}}{\text{zone}} \right)$$

$$\text{Flow} = (45,000 \text{ gal/day}) (80 \text{ days/yr})$$

$$\boxed{\text{Flow} = 3,600,000 \text{ gal/year}}$$

$$\boxed{\text{Total Landscaping Flow} = 4,524,000 \text{ gal/year}}$$

FORT DRUM'S WATER USAGE

| | DANC WATER | WELL WATER | TOTAL WATER GALLONS | GALS PER DAY | % OF WATER PURCHASED | % OF WELL WATER |
|--------|---------------|---------------|------------------------|-----------------|-------------------------|--------------------|
| OCT 93 | 43,488,630 | 15,313,635 | 58,802,265 | 1,896,847 | 73.96% | 26.04% |
| NOV 93 | 42,813,663 | 9,806,692 | 52,620,355 | 1,754,012 | 81.36% | 18.64% |
| DEC 93 | 46,743,913 | 11,572,348 | 58,316,261 | 1,881,170 | 80.16% | 19.84% |
| JAN 94 | 46,503,684 | 15,353,848 | 61,857,532 | 1,995,404 | 75.18% | 24.82% |
| FEB 94 | 41,222,663 | 10,786,765 | 52,009,428 | 1,857,480 | 79.26% | 20.74% |
| MAR 94 | 46,726,426 | 15,474,860 | 62,201,286 | 2,006,493 | 75.12% | 24.88% |
| APR 94 | 41,829,710 | 7,526,368 | 49,356,078 | 1,645,203 | 84.75% | 15.25% |
| MAY 94 | 45,029,906 | 11,867,234 | 56,897,140 | 1,835,392 | 79.14% | 20.86% |
| JUN 94 | 44,536,151 | 21,973,407 | 66,509,558 | 2,216,985 | 66.96% | 33.04% |
| JUL 94 | 46,427,149 | 24,059,671 | 70,486,820 | 2,273,768 | 65.87% | 34.13% |
| AUG 94 | 46,500,721 | 17,838,670 | 64,339,391 | 2,075,464 | 72.27% | 27.73% |
| SEP 94 | 40,857,108 | 11,493,547 | 52,350,655 | 1,745,022 | 78.05% | 21.95% |
| FY 94 | 532,679,724 | 173,067,045 | 705,746,769 | 1,933,553 | 75.48% | 24.52% |
| OCT 94 | 38,856,675 | 7,094,404 | 45,951,079 | 1,482,293 | 84.56% | 15.44% |
| NOV 94 | 36,107,144 | 6,330,919 | 42,438,063 | 1,414,602 | 85.08% | 14.92% |
| DEC 94 | 46,306,777 | 7,823,514 | 54,130,291 | 1,746,138 | 85.55% | 14.45% |
| JAN 95 | 46,471,194 | 14,400,370 | 60,871,564 | 1,963,599 | 76.34% | 23.66% |
| FEB 95 | 41,133,980 | 10,328,010 | 51,461,990 | 1,837,928 | 79.93% | 20.07% |
| MAR 95 | 46,226,124 | 9,866,787 | 56,092,911 | 1,809,449 | 82.41% | 17.59% |
| APR 95 | 46,010,361 | 7,600,496 | 53,610,857 | 1,787,029 | 85.82% | 14.18% |
| MAY 95 | 47,105,160 | 17,641,697 | 64,746,857 | 2,088,608 | 72.75% | 27.25% |
| JUN 95 | 51,915,343 | 33,108,355 | 85,023,698 | 2,834,123 | 61.06% | 38.94% |
| JUL 95 | 45,275,548 | 36,901,399 | 82,176,947 | 2,650,869 | 55.10% | 44.90% |
| AUG 95 | 45,425,295 | 32,655,708 | 78,081,003 | 2,518,742 | 58.18% | 41.82% |
| SEP 95 | 44,865,012 | 22,623,044 | 67,488,056 | 2,249,602 | 66.48% | 33.52% |
| FY 95 | 535,698,613 | 206,374,703 | 742,073,316 | 2,033,078 | 72.19% | 27.81% |

FORT DRUM

| METERED WATER USERS | FY 94 K GALS METERED | FY 95 K GALS METERED |
|---------------------------|-------------------------|-------------------------|
| P-10730B PX | 1,623 | 1,703 |
| P-10720 BURGER KING | 389 | 376 |
| P-10502 SPINNERS | 538 | 557 |
| P-2300 OLD PX | 558 | 599 |
| P-4320 MINI MALL | 3,511 | 3,149 |
| P-11005 N ENTRY MINI MALL | 93 | 80 |
| P-10207 PENNANTS | 559 | 445 |
| P-11110 GAS STATION | 55 | 53 |
| P-10730A COMMISSARY | 790 | 815 |
| P-4205 INN @ FT DRUM | 5,252 | 5,213 |
| P-6000 NJNG | 358 | 307 |
| P-6001 NJNG | 345 | 592 |
| P-4515 J.A. JONES | 71 | 151 |
| P-10762 KEY BANK | 95 | 35 |

WATER AUDIT WORKSHEET

For: Ft. Drum, NYAudit Study Period: August 1993 - July 1995

| | | Water Volume | | |
|-----------------------------------|--|--------------|------------------|--------|
| Line | Item | Subtotal | Total Cumulative | Units* |
| Task 1—Measure Supply | | | | |
| 1 | Uncorrected total water supply to the distribution system (total of master meters) | 709,300,653 | | gal/yr |
| 2A-C | Adjustments to total water supply | | | |
| 2A | Source meter error (+ or -) | | | |
| 2B | Change in reservoir and tank storage (+ or -) | | | |
| 2C | Other contributions or losses (+ or -) | | | |
| 3 | Total adjustments to total water supply (add lines 2A, 2B, and 2C) | | | |
| 4 | Adjusted total water supply to the distribution system (add line 1 and line 3) | 709,300,653 | | " |
| Task 2—Measure Metered Use | | | | |
| 5 | Uncorrected total metered water use | 17,308,500 | | " |
| 6 | Adjustments due to meter reading lag time (+ or -) | | | |
| 7 | Metered deliveries (add lines 5 and 6) | | | |
| 8A-C | Total sales meter error and system-service meter errors (+ or -) | | | |
| 8A | Residential meter error | | | |
| 8B | Large meter error | | | |
| 8C | Total (add line 8A and 8B) | | | |
| 9 | Corrected total metered water deliveries (add lines 7 and 8C) | 17,308,500 | | |
| 10 | Corrected total unmetered water (subtract line 9 from line 4) | | 691,992,153 | " |
| 11A-M | Authorized unmetered water uses | | | |
| 11A | Firefighting and firefighting training | 576,000 | | " |
| 11B | Main flushing | 528,000 | | " |

NOTE: 1 ac-ft = 43,560 ft³ = 325,851 gal.

*Units of measure must be consistent throughout the worksheet. The particular unit used (that is, acre-feet, millions of gallons, cubic feet, cubic metres, or other unit) is left to the user.

Form continues on next page.

| Line | Item | Water Volume | | |
|-------|--|--------------------|-------------------|----------------|
| | | Subtotal | Total Cumulative | Units* |
| 11A-M | Authorized unmetered water uses (continued) | | | |
| 11C | <i>Domestic water consumption</i> Storm drain flushing | <i>596,420,000</i> | | <i>gal/yr.</i> |
| 11D | Sewer cleaning | | | |
| 11E | Street cleaning | | | |
| 11F | Schools | | | |
| 11G | Landscaping in large public areas: | | | |
| | Parks | <i>4,524,000</i> | | <i>"</i> |
| | Golf courses | | | |
| | Cemeteries | | | |
| | Playgrounds | | | |
| | Highway median strips | | | |
| | Other landscaping | | | |
| 11H | Decorative water facilities | | | |
| 11I | Swimming pools | | | |
| 11J | Construction sites | | | |
| 11K | Water quality and other testing (pressure testing pipe, water quality, etc.) | | | |
| 11L | Process water at treatment plants | | | |
| 11M | Other unmetered uses | <i>6,450,000</i> | | <i>"</i> |
| 12 | Total authorized unmetered water (add lines 11A through 11M) | <i>603,498,000</i> | | <i>"</i> |
| 13 | Total water losses (subtract line 12 from line 10) | | <i>83,494,153</i> | <i>"</i> |
| 14A-H | Identified water losses | | | |
| 14A | Accounting procedure errors | | | |
| 14B | Illegal connections | | | |
| 14C | Malfunctioning distribution system controls | | | |
| 14D | Reservoir seepage and leakage | | | |
| 14E | Evaporation | | | |

NOTE: 1 ac-ft = 43,560 ft³ = 325,851 gal.

*Units of measure must be consistent throughout the worksheet. The particular unit used (that is, acre-feet, millions of gallons, cubic feet, cubic metres, or other unit) is left to the user.

Form continues on next page.

| Line | Item | Water Volume | | |
|-------|--|--------------|------------------|---------|
| | | Subtotal | Total Cumulative | Units* |
| 14A-H | Identified water losses (continued) | | | |
| 14F | Reservoir overflow | | | |
| 14G | Discovered leaks | | | |
| 14H | Theft | | | |
| 15 | Total identified water losses (add lines 14A through 14H) | | | |
| 16 | Potential water system leakage (subtract line 15 from line 13) | | 63,494,153 | gal/yr. |
| 17 | Recoverable leakage (multiply line 16 by 0.75) | | 62,620,615 | " |

| Line | Item | Dollars per Unit of Volume |
|-------|---|----------------------------|
| 18A-B | Cost savings | |
| 18A | Cost of water supply | \$ 0.697 / kgal |
| 18B | Variable operation and maintenance costs | \$ 0.126 / kgal |
| 19 | Total costs per unit of recoverable leakage (add line 18A and line 18B) | \$ 0.823 / kgal |

| Line | Item | Dollars per Year |
|------|---|------------------|
| 20 | One-year benefit from recoverable leakage (multiply line 17 by line 19) | \$ 51,536 |
| 21 | Total benefits from recovered leakage (multiply line 20 by 2) | \$ 103,072 |
| 22 | Total costs of leak detection project | \$ 26,000 |
| 23 | Benefit to cost ratio (divide line 21 by line 22) | 4.0 |

Prepared by:

Name Tom Pieling

Title EMC Engineers, Inc. Date 2/14/96

NOTE: 1 ac-ft = 43,560 ft³ = 325,851 gal.

*Units of measure must be consistent throughout the worksheet. The particular unit used (that is, acre-feet, millions of gallons, cubic feet, cubic metres, or other unit) is left to the user.

ECO #6 LCCA

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

| | | |
|---|----------------------|----------------------|
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 |
| ANALYSIS DATE: 05/10/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP |

1. INVESTMENT: ECO #6 - Connecting Valve Pit Actuators to Telemetry System

| | | |
|--|------------------|----------------|
| A. CONSTRUCTION COST | = | \$2,899 |
| B. SIOH COST | (6.0% of 1A) = | \$174 |
| C. DESIGN COST | (6.0% of 1A) = | \$174 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$3,247 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$3,247 |

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS:

OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|------------------|--------------------------|------------------------|--------------------------|------------------------|---------------------------|
| A. ELECTRICAL | \$0.025 | 396 | \$10 | 13.86 | \$137 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. | | 0 | \$0 | | \$0 |
| G. TOTAL | | 396 | \$10 | | -----> \$137 |

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

Unit Cost * 396 KGAL

| | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|---|--------------------------|------------------------|---------------------------|
| 1 DANC Variable Savings (\$0.67/KGAL) | \$266 | 13.47 | \$3,585 |
| 2 Ft. Drum O&M Savings (\$0.028/KGAL) | \$11 | 13.47 | \$149 |
| 3 Ft Drum Chemical Savings (\$0.031/KGAL) | \$12 | 13.47 | \$165 |
| 4 Reservoir Savings (\$0.067/KGAL) | \$27 | 13.47 | \$357 |
| 5 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$316 | | \$4,257 |

B. NON-RECURRING (+/-)

| ITEM | SAVINGS (+) COST(-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/ COST (4) |
|----------|----------------------------|---------------------------|---------------------------------------|------------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. | | | | \$0 |
| d. TOTAL | \$0 | | | \$0 |

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = \$4,257

| | | |
|--|-----------------------------------|---------|
| 4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) | (2H3 + 3A + (3Bd1/Economic Life)) | \$326 |
| 5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) | (1G/4) = | 9.96 |
| 6. TOTAL NET DISCOUNTED SAVINGS | (2H5 + 3C) = | \$4,394 |
| 7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) | (6/1G) = | 1.35 |
| (MUST HAVE SIR > 1.25 TO QUALIFY) | | |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | | | SHEET 1 OF 1 | |
|-------------------------------------|----------------------------|-----------------|------|-------------------------|-------|---------------|---------|------------------|-------|------------|---------|--------------|--|
| AREA | | ACTIVITY | | LOCATION | | AMENDMENT NO. | | | | | | | |
| PROJECT TITLE | | DESCRIPTION | | CONNECT VALVE ACTUATORS | | CONTRACT NO. | | DACA01-94-D-0033 | | | | | |
| WATER CONSERVATION STUDY | | | | | | | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | | | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | | |
| 1 | CONNECT VALVE ACTUATORS | | | | | | | | | | | | |
| 2 | LABOR HOURS - TANK 3 | HRS | 30 | \$0.00 | \$0 | \$29.30 | \$864 | \$0.00 | \$0 | \$29 | \$864 | | |
| 3 | LABOR HOURS - VALVE PIT #4 | HRS | 30 | \$0.00 | \$0 | \$29.30 | \$864 | \$0.00 | \$0 | \$29 | \$864 | | |
| 4 | LABOR HOURS - T-4000 PANEL | HRS | 30 | \$0.00 | \$0 | \$29.30 | \$864 | \$0.00 | \$0 | \$29 | \$864 | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
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| 14 | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | |
| 22 | CONSTRUCTION SUBTOTAL | | 89 | | \$0 | | \$2,593 | | \$0 | | \$2,593 | | |
| 23 | LOCATION FACTOR | % | | 81.80% | \$0 | 111.80% | \$2,899 | 100.00% | \$0 | | \$2,899 | | |
| 24 | GRAND TOTAL | | | | \$0 | | \$2,899 | | \$0 | | \$2,899 | | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | | | DATE | | | | | |
| TCP | | | | E M C Engineers, Inc. | | | | 2/22/96 | | | | | |

E M C ENGINEERS, INC.

Denver, CO (303) 988-2915
Atlanta, GA (404) 642-1864
Dallas, TX (214) 602-1356

JOB Ft. Drum Water Study 1406-012
SHEET NO. 1 OF 3
CALCULATED BY TER DATE 2/8/96
CHECKED BY _____ DATE _____
SCALE _____

Connecting Valve Actuators

Ft. Drum is currently experiencing problems with stagnating water and low chlorine residuals in areas in the old Post. Conversations with Ft. Drum personnel revealed that main line valves must be manually opened to send water from the old Post to the new Post. If the valves could be automatically opened, more water could be circulated through these areas (Area 8500 is an example), alleviating some stagnation problems.

There are three main lines that connect the old and new Post:

1. Value Pit #3: 20" main line connection in the 4400 Area near 4th Street East
2. Value Pit #4: 16" main line connection in the 4300 Area near Conway Road.
3. Value Vault: 8" main line connection in the 8300 Area near Lewis Ave.

Value Vault #3 is already connected to the telemetry system. Value Vault #4 is not connected to the telemetry system, but the material has been procured and installed.

The value vault in the 8200 Area does not have valve actuators installed.

Plumbing shop personnel would like to be able to automatically alternate flow through Value Vaults 3 and 4 to increase water circulation to the west end of the old post.

Materials have already been procured for connection of Vault 4 valves to the telemetry system. Manpower is needed to connect these wires to the master control panel at Bldg T-4000.

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JOB Ft. Drum Water Study 1406-012
SHEET NO. 2 OF 3
CALCULATED BY TCP DATE 2/8/96
CHECKED BY _____ DATE _____
SCALE _____

Connecting Valve Actuators - (cont)

Cost:

According to interviews with Ft. Drum personnel, a minimum of 3-4 people would be required to connect the existing valve pit valve actuators to the telemetry system:

- One person located in Valve Vault #4.
- One person located at Tank #3
- One person located at Area 5500 PRV.
- One person located at master telemetry panel (T-4000)

Assume labor costs similar to electricians (labor cost taken from Means Mechanical 1996) for 4 persons to connect the actuators to the telemetry system.

Savings

- Total water lost through hydrants for maintenance purposes: 528,000 gal/year (according to water audit)
- Assume hydrants are opened twice a week for 22 weeks (May through September)
- Assume hydrants are opened for 10 min. at a time.
- Assume hydrant flow = 1200 gpm
- Assume about 75% of hydrant use (stagnation) is attributed to improving circulation in western end of old Post.

$$\therefore \text{Savings} = (2)(22 \text{ weeks})(10 \text{ min.})(1200 \text{ gpm})(0.75)$$

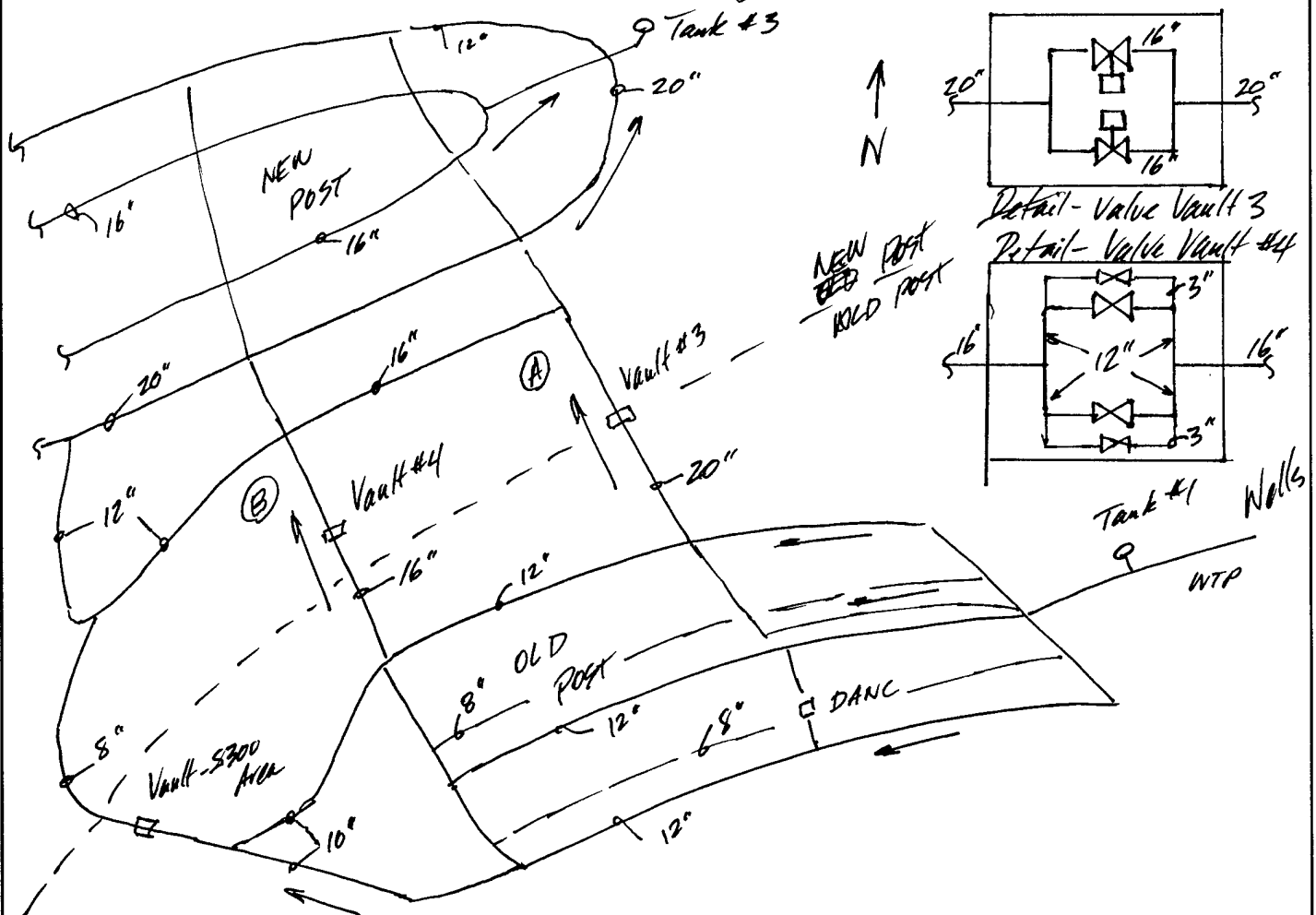
$$\text{Savings} = 396,000 \text{ gal/year}$$

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 Dallas, TX (214) 602-1356

JOB Ft. Drum Water Study 1406-012
 SHEET NO. 3 OF 3
 CALCULATED BY TCP DATE 2/8/96
 CHECKED BY _____ DATE _____
 SCALE _____

Schematic of Water Distribution System - Valve Vaults



- ① Water tends to flow from the old Post and wells toward the Tank #3. If the valve at Vault #3 is open, water does not circulate towards the west end of the old Post.
- ② If the valves in Vault #4 can be opened on regular basis, water will tend to flow towards the west end of the old Post, improving stagnation problems.

ECO #7 LCCA

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

| | | |
|---|----------------------|----------------------|
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 |
| ANALYSIS DATE: 05/10/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP |

1. INVESTMENT: ECO #7 - Reconnect Isolated Main Line

| | | |
|--|------------------|-----------------|
| A. CONSTRUCTION COST | = | \$10,119 |
| B. SIOH COST | (6.0% of 1A) = | \$607 |
| C. DESIGN COST | (6.0% of 1A) = | \$607 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$11,333 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$11,333 |

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS:

OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|------------------|--------------------------|------------------------|--------------------------|------------------------|---------------------------|
| A. ELECTRICAL | \$0.025 | 132 | \$3 | 13.86 | \$46 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. | | | | | |
| G. TOTAL | | 132 | \$3 | | -----> \$46 |

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

Unit Cost * 132 KGAL

| | | | | |
|---|---|-------|-------|---------|
| 1 | DANC Variable Savings (\$0.67/KGAL) | \$89 | 13.47 | \$1,195 |
| 2 | Ft. Drum O&M Savings (\$0.028/KGAL) | \$4 | 13.47 | \$50 |
| 3 | Ft Drum Chemical Savings (\$0.031/KGAL) | \$4 | 13.47 | \$55 |
| 4 | Reservoir Savings (\$0.067/KGAL) | \$9 | 13.47 | \$119 |
| 5 | TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$105 | | \$1,419 |

B. NON-RECURRING (+/-)

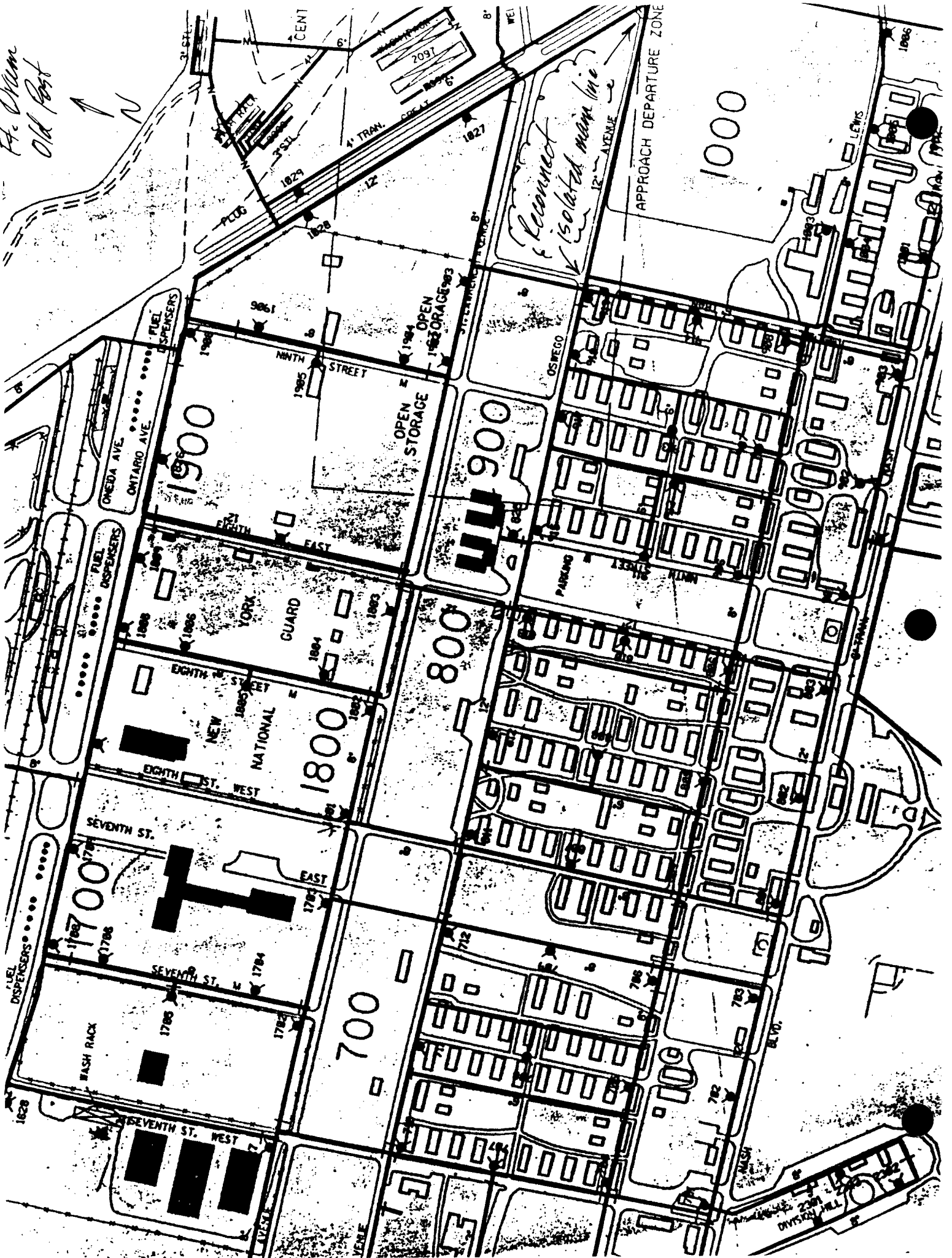
| ITEM | SAVINGS (+) COST (-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/COST (4) |
|----------|-----------------------------|---------------------------|---------------------------------------|--------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. | | | | \$0 |
| d. TOTAL | \$0 | | | \$0 |

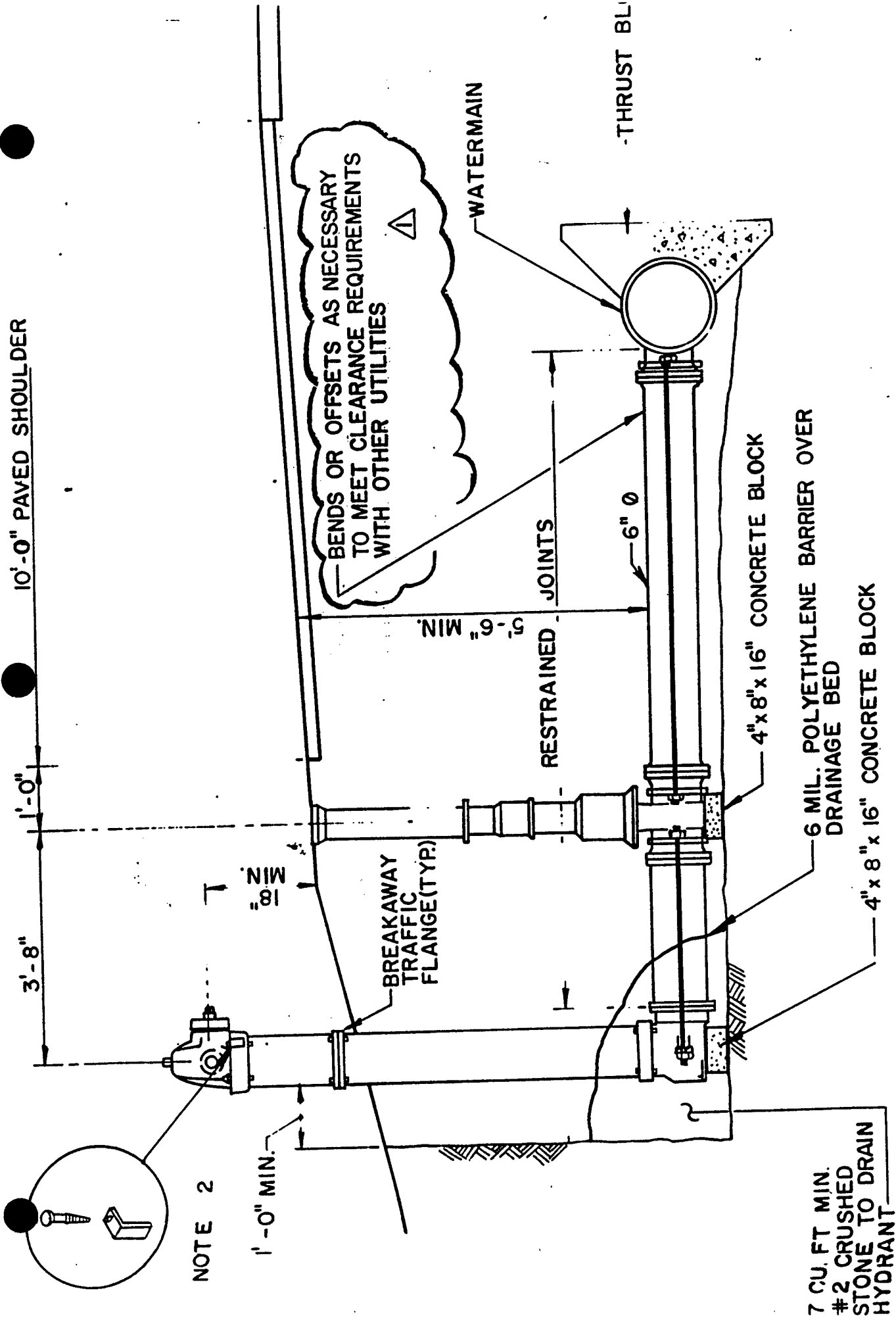
C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = \$1,419

| | | |
|--|-----------------------------------|---------|
| 4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) | (2G3 + 3A + (3Bd1/Economic Life)) | \$109 |
| 5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) | (1G/4) = | 104.32 |
| 6. TOTAL NET DISCOUNTED SAVINGS | (2H5 + 3C) = | \$1,465 |
| 7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY) | (6/1G) = | 0.13 |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | SHEET | 1 | OF | 2 |
|-------------------------------------|------------------------------|-----------------|------|------------------------------|---------|---------------|-------|----------------|-------|------------------|---------|-----------|-------|
| AREA | | ACTIVITY | | LOCATION | | AMENDMENT NO. | | | | | | | |
| PROJECT TITLE | | DESCRIPTION | | RECONNECT ISOLATED MAIN LINE | | CONTRACT NO. | | | | DACA01-94-D-0033 | | | |
| WATER CONSERVATION STUDY | | | | | | | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | | Unit Cost | Total |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | | |
| 1 | RECONNECT ISOLATED MAIN LINE | | | | | | | | | | | | |
| 2 | EXCAVATION | CY | 24 | \$0.00 | \$0 | \$1.56 | \$37 | \$1.58 | \$38 | \$3 | \$75 | | |
| 3 | PIPING DEMO, UP TO 12" | LF | 5 | \$0.00 | \$0 | \$3.43 | \$17 | \$1.39 | \$7 | \$5 | \$24 | | |
| 4 | PIPING, 12" | LF | 10 | \$18.50 | \$185 | \$9.00 | \$90 | \$1.51 | \$15 | \$29 | \$290 | | |
| 5 | CRUSHED ROCK BEDDING | CY | 4 | \$13.00 | \$52 | \$3.43 | \$14 | \$1.39 | \$6 | \$18 | \$71 | | |
| 6 | BACKFILL | CY | 20 | \$0.00 | \$0 | \$0.71 | \$14 | \$0.58 | \$12 | \$1 | \$26 | | |
| 7 | COMPACTION | CY | 24 | \$0.00 | \$0 | \$0.86 | \$21 | \$0.33 | \$8 | \$1 | \$29 | | |
| 8 | TOTAL - ONE MAIN CONNECTION | | 1 | | \$237 | | \$193 | | \$85 | | \$515 | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | |
| 13 | HYDRANT REPLACEMENT | | | | | | | | | | | | |
| 14 | EXCAVATION | CY | 30 | \$0.00 | \$0 | \$1.56 | \$47 | \$1.58 | \$47 | \$3.14 | \$94 | | |
| 15 | TEE, 12" | EA | 1 | \$258.00 | \$258 | \$38.50 | \$39 | \$0.00 | \$0 | \$296.50 | \$297 | | |
| 16 | PIPING, 06" | LF | 20 | \$8.45 | \$169 | \$4.29 | \$86 | \$0.00 | \$0 | \$12.74 | \$255 | | |
| 17 | GATE VALVE, 06" | EA | 1 | \$450.00 | \$450 | \$135.00 | \$135 | \$0.00 | \$0 | \$585.00 | \$585 | | |
| 18 | HYDRANT | EA | 1 | \$1,250 | \$1,250 | \$129.00 | \$129 | \$21.50 | \$22 | \$1,401 | \$1,401 | | |
| 19 | THRUST BLOCK | CY | 3 | \$81.50 | \$245 | \$110.10 | \$330 | \$0.00 | \$0 | \$191.60 | \$75 | | |
| 20 | BACKFILL | CY | 20 | \$0.00 | \$0 | \$0.71 | \$14 | \$0.58 | \$12 | \$1.29 | \$26 | | |
| 21 | CRUSHED ROCK BEDDING | CY | 10 | \$13.00 | \$130 | \$3.43 | \$34 | \$1.39 | \$14 | \$17.82 | \$178 | | |
| 22 | COMPACTION | CY | 30 | \$0.00 | \$0 | \$0.86 | \$26 | \$0.33 | \$10 | \$1.19 | \$36 | | |
| 23 | TOTAL - ONE HYDRANT | | 1 | | \$2,502 | | \$793 | | \$57 | | \$3,351 | | |
| 24 | | | | | | | | | | | | | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | DATE | | | | | | | |
| TCP | | | | E M C Engineers, Inc. | | 2/14/96 | | | | | | | |

Ft. Drum
Old Post





FIRE HYDRANT — EARTH SECTION FILL OR CUT N.T.S.

Cost Estimate Back-up Data

OPTIMUM COST OF WATER AT FT. DRUM - BASED ON 1995 WATER PRICES

Assume total water consumption: 709,300,653 (Assume water demand equal to 1994 and 1995 average)
Assume DANC Cost: \$0.90 (Assume only variable costs, not fixed costs, apply)
Assume Electrical Cost: \$0.072 (Assume annual increase of 4.1% - based on FEMP discount factors)
Assume Ft. Drum O&M Cost: \$20,105 (Assume annual increase of 10%, based on Ft. Drum data)
Assume Chemical Treatment Cost: \$5,550 (Assume chemical treatment cost will increase as well flow increases, cost based on Ft. Drum data)
Assume Reservoir Cost: \$0.067 (Assume 65,368.6 kWh x \$0.072/kWh = \$4,707 / 70,582,275 kgal)

| Usage Per Well (gpm) | Total Well Hours | Well Flow (gal) | % of Total Flow | DANC Cost | | | | Ft. Drum Cost | | | | |
|----------------------|------------------|-----------------|-----------------|-----------|-----------------|----------------|-------------------|------------------|-----------------|--------------------|-----------------------|-------------------|
| | | | | DANC Cost | O&M Cost - DANC | Reservoir Cost | Total Cost - DANC | Well Elect. Cost | O&M Cost - Drum | Chemical Treatment | Reservoir Cost - Drum | Total Cost - Drum |
| Existing | 16,515 | 180,282,960 | 25.42% | \$0.671 | \$0.0211 | \$0.050 | \$0.742 | \$0.026 | \$0.0072 | \$0.031 | \$0.017 | \$0.823 |
| 2,000 | 22,000 | 270,000,000 | 38.07% | \$0.557 | \$0.0176 | \$0.041 | \$0.616 | \$0.035 | \$0.0108 | \$0.031 | \$0.026 | \$0.719 |
| 2,200 | 24,200 | 297,000,000 | 41.87% | \$0.523 | \$0.0165 | \$0.039 | \$0.579 | \$0.039 | \$0.0119 | \$0.031 | \$0.028 | \$0.688 |
| 2,400 | 26,400 | 324,000,000 | 45.68% | \$0.489 | \$0.0154 | \$0.036 | \$0.541 | \$0.043 | \$0.0129 | \$0.031 | \$0.031 | \$0.658 |
| 2,600 | 28,600 | 351,000,000 | 49.49% | \$0.455 | \$0.0143 | \$0.034 | \$0.503 | \$0.046 | \$0.0140 | \$0.031 | \$0.033 | \$0.627 |
| 2,800 | 30,800 | 378,000,000 | 53.29% | \$0.420 | \$0.0132 | \$0.031 | \$0.465 | \$0.050 | \$0.0151 | \$0.031 | \$0.036 | \$0.596 |
| 3,000 | 33,000 | 405,000,000 | 57.10% | \$0.386 | \$0.0122 | \$0.029 | \$0.427 | \$0.053 | \$0.0162 | \$0.031 | \$0.038 | \$0.565 |
| 3,200 | 35,200 | 432,000,000 | 60.91% | \$0.352 | \$0.0111 | \$0.026 | \$0.389 | \$0.057 | \$0.0173 | \$0.031 | \$0.041 | \$0.535 |
| 3,400 | 37,400 | 459,000,000 | 64.71% | \$0.318 | \$0.0100 | \$0.024 | \$0.351 | \$0.060 | \$0.0183 | \$0.031 | \$0.043 | \$0.504 |
| 3,600 | 39,600 | 486,000,000 | 68.52% | \$0.283 | \$0.0089 | \$0.021 | \$0.313 | \$0.064 | \$0.0194 | \$0.031 | \$0.046 | \$0.473 |
| 3,800 | 41,800 | 513,000,000 | 72.32% | \$0.249 | \$0.0078 | \$0.019 | \$0.275 | \$0.067 | \$0.0205 | \$0.031 | \$0.048 | \$0.443 |
| 4,000 | 44,000 | 540,000,000 | 76.13% | \$0.215 | \$0.0068 | \$0.016 | \$0.238 | \$0.071 | \$0.0216 | \$0.031 | \$0.051 | \$0.412 |
| 4,200 | 46,200 | 567,000,000 | 79.94% | \$0.181 | \$0.0057 | \$0.013 | \$0.200 | \$0.074 | \$0.0227 | \$0.031 | \$0.054 | \$0.381 |
| 4,400 | 48,400 | 594,000,000 | 83.74% | \$0.146 | \$0.0046 | \$0.011 | \$0.162 | \$0.078 | \$0.0237 | \$0.031 | \$0.056 | \$0.350 |
| 4,600 | 50,600 | 621,000,000 | 87.55% | \$0.112 | \$0.0035 | \$0.008 | \$0.124 | \$0.081 | \$0.0248 | \$0.031 | \$0.059 | \$0.320 |
| 4,650 | 51,150 | 627,750,000 | 88.50% | \$0.103 | \$0.0033 | \$0.008 | \$0.114 | \$0.082 | \$0.0251 | \$0.031 | \$0.059 | \$0.312 |
| 4,700 | 51,700 | 634,500,000 | 89.45% | \$0.095 | \$0.0030 | \$0.007 | \$0.105 | \$0.083 | \$0.0254 | \$0.031 | \$0.060 | \$0.304 |
| 4,750 | 52,250 | 641,250,000 | 90.41% | \$0.086 | \$0.0027 | \$0.006 | \$0.095 | \$0.084 | \$0.0256 | \$0.031 | \$0.061 | \$0.297 |
| 4,800 | 52,800 | 648,000,000 | 91.36% | \$0.078 | \$0.0024 | \$0.006 | \$0.086 | \$0.085 | \$0.0259 | \$0.031 | \$0.061 | \$0.289 |
| 5,000 | 55,000 | 675,000,000 | 95.16% | \$0.044 | \$0.0014 | \$0.003 | \$0.048 | \$0.089 | \$0.0270 | \$0.031 | \$0.064 | \$0.258 |
| 5,100 | 56,100 | 688,500,000 | 97.07% | \$0.026 | \$0.0008 | \$0.002 | \$0.029 | \$0.090 | \$0.0275 | \$0.031 | \$0.065 | \$0.243 |
| 5,180 | 56,980 | 699,300,000 | 98.59% | \$0.013 | \$0.0004 | \$0.001 | \$0.014 | \$0.092 | \$0.0279 | \$0.031 | \$0.066 | \$0.231 |
| 5,190 | 57,090 | 700,650,000 | 98.78% | \$0.011 | \$0.0003 | \$0.001 | \$0.012 | \$0.092 | \$0.0280 | \$0.031 | \$0.066 | \$0.229 |
| 5,200 | 57,200 | 702,000,000 | 98.97% | \$0.009 | \$0.0003 | \$0.001 | \$0.010 | \$0.092 | \$0.0281 | \$0.031 | \$0.066 | \$0.227 |

ELECTRICAL CONSUMPTION - FT. DRUM (WELLS, RESERVOIR PUMPS) & DANC

A full year of data taken from the telemetry system was taken from August to July.

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total | Reservoir Pump |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------------|
| Avg. (Hours) | 1,098 | 2,070 | 1,585 | 1,050 | 1,954 | 1,315 | 2,146 | 1,331 | 1,676 | 1,007 | 1,283 | 16,515 | 2,614 |
| Flow (gpm) | 410 | 125 | 75 | 410 | 125 | 150 | 75 | 185 | 220 | 285 | 190 | 2,249 | 450 |
| Flow (gal) | 27,004,212 | 15,512,580 | 7,122,039 | 25,823,700 | 14,642,104 | 11,827,110 | 9,642,975 | 14,785,315 | 22,112,138 | 17,213,054 | 14,617,732 | 180,282,960 | |
| Motor HP | 40 | 20 | 15 | 40 | 15 | 15 | 15 | 20 | 25 | 40 | 30 | - | 40 |
| Motor Effic. | 89.5% | 87.5% | 86.0% | 89.5% | 86.0% | 86.0% | 86.0% | 87.5% | 88.0% | 89.5% | 88.5% | - | 89.5% |
| Motor kW | 25.0 | 12.8 | 9.8 | 25.0 | 9.8 | 9.8 | 9.8 | 12.8 | 15.9 | 25.0 | 19.0 | 174.49 | 25.0 |
| Motor kWh | 27,456.1 | 26,472.3 | 15,467.6 | 26,255.9 | 19,068.5 | 12,832.7 | 20,942.2 | 17,021.6 | 26,639.8 | 25,180.6 | 24,333.5 | 241,670.9 | 65,364.6 |
| kWh Cost | \$1,977 | \$1,906 | \$1,114 | \$1,890 | \$1,373 | \$924 | \$1,508 | \$1,226 | \$1,918 | \$1,813 | \$1,752 | \$17,400 | \$4,706 |

COST OF WATER - DISTRIBUTION SYSTEM - BASED ON 1995 WATER PRICES

Avg. KW: 15.86
Avg. GPM: 204.44

Total Ft. Drum O&M Cost: \$20,105 (Based on FY95 value supplied by Ft. Drum)
Total Chemical Treatment Cost: \$5,550 (=5550 * Flow Rate/180,282,960)

Total Well Operation (hrs): 16,515
Total Well kWh Cost: \$17,400 (Based on \$0.072/kWh)
Total Well Production (gal): 180,282,960 (Average value per year from Aug-93 to Jul-95)
Cost of Drum Water (per kGal) \$0.097

Total Reservoir Pump Cost: \$4,706 (Based on \$0.072/kWh)
Total Reservoir Pump (gal): 70,578,000 (Based on flow rate of 450 gpm)
Cost of Res. Water (per kGal): \$0.067

DANC - Variable Costs: \$476,527
DANC Production (gal): 529,017,693 (Average value per year from Aug-93 to Jul-95)
Total DANC Cost (per KGal): \$0.90 (Taken from Schedule A for 1997)

| DANC Water Cost / kGal | | Ft. Drum Electrical Cost / kGal | | Ft. Drum O & M Cost/ kGal | | Ft. Drum Chem. Cost | | Reservoir Pump Cost/ kGal | |
|------------------------|---------|---------------------------------|---|---------------------------|---------|---------------------|----------|---------------------------|---------|
| Total Cost: | \$0.90 | 529,018 | + | \$0.097 | 180,283 | + | \$20,105 | + | \$4,706 |
| | | 709,301 | | | 709,301 | | 709,301 | | 70,578 |
| Total Cost: | \$0.90 | 74.58% | + | \$0.097 | 25.42% | + | \$0.028 | + | \$0.067 |
| Total Cost: | \$0.672 | | + | \$0.025 | | + | \$0.028 | + | \$0.067 |

Total Cost: \$0.82 per kGal

ELECTRICAL CONSUMPTION - FT. DRUM (WELLS, RESERVOIR PUMPS) & DANC

A full year of data taken from the telemetry system was taken from August to July.

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total | Reservoir Pump |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------------|
| Avg. (Hours) | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 22,000 | 2,614 |
| Flow (gpm) | 410 | 125 | 75 | 410 | 125 | 150 | 75 | 185 | 220 | 285 | 190 | 2,249 | 450 |
| Flow (gal) | 49,188,000 | 14,988,000 | 8,986,800 | 49,188,000 | 14,986,800 | 17,988,000 | 8,986,930 | 22,186,800 | 26,386,800 | 34,186,800 | 22,786,800 | 269,859,730 | |
| Motor HP | 40 | 20 | 15 | 40 | 15 | 15 | 15 | 20 | 25 | 40 | 30 | - | 40 |
| Motor Effic. | 89.5% | 87.5% | 86.0% | 89.5% | 86.0% | 86.0% | 86.0% | 87.5% | 88.0% | 89.5% | 88.5% | - | 89.5% |
| Motor kW | 25.0 | 12.8 | 9.8 | 25.0 | 9.8 | 9.8 | 9.8 | 12.8 | 15.9 | 25.0 | 19.0 | 174.49 | 25.0 |
| Motor kWh | 50,011.2 | 25,577.1 | 19,517.4 | 50,011.2 | 19,517.4 | 19,517.4 | 19,517.4 | 25,577.1 | 31,789.8 | 50,011.2 | 37,932.2 | 348,979.5 | 65,364.6 |
| kWh Cost | \$3,601 | \$1,842 | \$1,405 | \$3,601 | \$1,405 | \$1,405 | \$1,405 | \$1,842 | \$2,289 | \$3,601 | \$2,731 | \$25,127 | \$4,706 |

COST OF WATER - DISTRIBUTION SYSTEM - BASED ON 1995 WATER PRICES

Avg. kW: 15.86

Avg. gpm: 204.44

Total O&M Cost: \$20,105
Total Chemical Treatment Cost: \$8,308
(Based on FY95 value supplied by Ft. Drum minus chemical treatment costs)
(=5550 * Flow Rate/180,282,960)

Total Well Operation (hrs): 22,000
Total Well kWh Cost: \$25,127
Total Well Production (gal): 269,859,730
Cost of Drum Water (per kGal) \$0.093
(Based on \$0.072/kWh)
(Average value per year from Aug-93 to Jul-95)

Total Reservoir Pump (min.): 156,840
Total Reservoir Pump Cost: \$4,706
Total Reservoir Pump (gal): 70,578,000
Cost of Res. Water (per kGal) \$0.067
(Based on \$0.078/kWh)
(Based on flow rate of 450 gpm)

DANC Production: 439,440,923
Total DANC Cost (per kGal): \$0.90
(Equal total usage of 709,300,653 minus well production)
(Taken from Schedule "A" for 1995, only variable water costs were included)

| DANC Water Cost / kGal | Ft. Drum Electrical Cost / kGal | O & M Cost/ kGal | Ft. Drum Chem. Cost | Reservoir Pump Cost/ kGal |
|-----------------------------|---------------------------------|------------------|---------------------|---------------------------|
| Total Cost: \$0.90 | \$0.093 | \$20,105 | \$8,308 | \$4,706 |
| | 709,301 | 709,301 | 269,860 | 70,578 |
| Total Cost: \$0.90 | \$0.093 | \$0.028 | \$0.031 | \$0.067 |
| | 61.95% | + | + | + |
| Total Cost: \$0.558 | \$0.035 | \$0.028 | \$0.031 | \$0.067 |
| | + | + | + | + |
| Total Cost: \$0.72 per kGal | | | | |

ELECTRICAL CONSUMPTION - FT. DRUM (WELLS, RESERVOIR PUMPS) & DANC

A full year of data taken from the telemetry system was taken from August to July.

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total | Reservoir Pump |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------------|
| Avg. (Hours) | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 33,000 | 2,614 |
| Flow (gpm) | 410 | 125 | 75 | 410 | 125 | 150 | 75 | 185 | 220 | 285 | 190 | 2,249 | 450 |
| Flow (gal) | 73,782,000 | 22,482,000 | 13,480,200 | 73,782,000 | 22,480,200 | 26,982,000 | 13,480,394 | 33,280,200 | 39,580,200 | 51,280,200 | 34,180,200 | 404,789,594 | |
| Motor HP | 40 | 20 | 15 | 40 | 15 | 15 | 15 | 20 | 25 | 40 | 30 | - | 40 |
| Motor Effic. | 89.5% | 87.5% | 86.0% | 89.5% | 86.0% | 86.0% | 86.0% | 87.5% | 88.0% | 89.5% | 88.5% | - | 89.5% |
| Motor kW | 25.0 | 12.8 | 9.8 | 25.0 | 9.8 | 9.8 | 9.8 | 12.8 | 15.9 | 25.0 | 19.0 | 174.49 | 25.0 |
| Motor kWh | 75,016.8 | 38,365.7 | 29,276.2 | 75,016.8 | 29,276.2 | 29,276.2 | 29,276.2 | 38,365.7 | 47,684.7 | 75,016.8 | 56,898.3 | 523,469.3 | 65,364.6 |
| kWh Cost | \$5,401 | \$2,762 | \$2,108 | \$5,401 | \$2,108 | \$2,108 | \$2,108 | \$2,762 | \$3,433 | \$5,401 | \$4,097 | \$37,690 | \$4,706 |

COST OF WATER - DISTRIBUTION SYSTEM - BASED ON 1995 WATER PRICES

Avg. kW: 15.86

Total O&M Cost: \$20,105
Total Chemical Treatment Cost: \$12,461
(Based on FY95 value supplied by Ft. Drum minus chemical treatment costs)
(=5550 * Flow Rate/180,282,960)

Avg. gpm: 204.44

Total Well Operation (hrs): 33,000
Total Well kWh Cost: \$37,690
Total Well Production (gal): 404,789,594
Cost of Drum Water (per kGal) \$0.093
(Based on \$0.072/kWh)
(Average value per year from Aug-93 to Jul-95)

Total Reservoir Pump (min.): 156,840
Total Reservoir Pump Cost: \$4,706
Total Reservoir Pump (gal): 70,578,000
Cost of Res. Water (per kGal) \$0.067
(Based on \$0.078/kWh)
(Based on flow rate of 450 gpm)

DANC Production: 304,511,059
Total DANC Cost (per KGal): \$0.90
(Equal total usage of 709,300,653 minus well production)
(Taken from Schedule "A" for 1995, only variable water costs were included)

| | DANC Water Cost / kGal | Ft. Drum Electrical Cost / kGal | O & M Cost/ kGal | Ft. Drum Chem. Cost | Reservoir Pump Cost/ kGal |
|-------------|------------------------|---------------------------------|------------------|---------------------|---------------------------|
| Total Cost: | \$0.90 | \$0.093 | \$20,105 | \$12,461 | \$4,706 |
| | 304,511 | 404,790 | 709,301 | 404,790 | 70,578 |
| | 709,301 | 709,301 | | | |
| Total Cost: | \$0.90 | \$0.093 | \$0.028 | \$0.031 | \$0.067 |
| | 42.93% | 57.07% | | | |
| Total Cost: | \$0.386 | \$0.053 | \$0.028 | \$0.031 | \$0.067 |
| Total Cost: | \$0.57 | | | | |

ELECTRICAL CONSUMPTION - FT. DRUM (WELLS, RESERVOIR PUMPS) & DANC

A full year of data taken from the telemetry system was taken from August to July.

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total | Reservoir Pump |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------------|
| Avg. (Hours) | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 44,000 | 2,614 |
| Flow (gpm) | 410 | 125 | 75 | 410 | 125 | 150 | 75 | 185 | 220 | 285 | 190 | 2,249 | 450 |
| Flow (gal) | 98,376,000 | 29,976,000 | 17,973,600 | 98,376,000 | 29,973,600 | 35,976,000 | 17,973,859 | 44,373,600 | 52,773,600 | 68,373,600 | 45,573,600 | 539,719,459 | |
| Motor HP | 40 | 20 | 15 | 40 | 15 | 15 | 15 | 20 | 25 | 40 | 30 | - | 40 |
| Motor Effic. | 89.5% | 87.5% | 86.0% | 89.5% | 86.0% | 86.0% | 86.0% | 87.5% | 88.0% | 89.5% | 88.5% | - | 89.5% |
| Motor kW | 25.0 | 12.8 | 9.8 | 25.0 | 9.8 | 9.8 | 9.8 | 12.8 | 15.9 | 25.0 | 19.0 | 174.49 | 25.0 |
| Motor kWh | 100,022.3 | 51,154.3 | 39,034.9 | 100,022.3 | 39,034.9 | 39,034.9 | 39,034.9 | 51,154.3 | 63,579.5 | 100,022.3 | 75,864.4 | 697,959.1 | 65,364.6 |
| kWh Cost | \$7,202 | \$3,683 | \$2,811 | \$7,202 | \$2,811 | \$2,811 | \$2,811 | \$3,683 | \$4,578 | \$7,202 | \$5,462 | \$50,253 | \$4,706 |

COST OF WATER - DISTRIBUTION SYSTEM - BASED ON 1995 WATER PRICES

Avg. kW: 15.86

(Based on FY95 value supplied by Ft. Drum minus chemical treatment costs)

(=5550 * Flow Rate/180,282,960)

Avg. gpm: 204.44

Total O&M Cost: \$20,105

Total Chemical Treatment Cost: \$16,615

Total Well Operation (hrs): 44,000

Total Well kWh Cost: \$50,253

Total Well Production (gal): 539,719,459

Cost of Drum Water (per kGal) \$0.093

(Based on \$0.072/kWh)

(Average value per year from Aug-93 to Jul-95)

Total Reservoir Pump (min.): 156,840

Total Reservoir Pump Cost: \$4,706

Total Reservoir Pump (gal): 70,578,000

Cost of Res. Water (per kGal) \$0.067

(Based on \$0.078/kWh)

(Based on flow rate of 450 gpm)

DANC Production: 169,581,194

Total DANC Cost (per KGal): \$0.90

(Equal total usage of 709,300,653 minus well production)

(Taken from Schedule "A" for 1995, only variable water costs were included)

| DANC Water Cost / kGal | Ft. Drum Electrical Cost / kGal | O & M Cost/ kGal | Ft. Drum Chem. Cost | Reservoir Pump Cost/ kGal |
|-----------------------------|---------------------------------|------------------|---------------------|---------------------------|
| Total Cost: \$0.90 | \$0.093 | \$20,105 | \$16,615 | \$4,706 |
| | 169,581 | 709,301 | 539,719 | 70,578 |
| | 709,301 | | | |
| Total Cost: \$0.90 | \$0.093 | \$0.028 | \$0.031 | \$0.067 |
| | 23.91% | | | |
| Total Cost: \$0.215 | \$0.071 | \$0.028 | \$0.031 | \$0.067 |
| | | | | |
| Total Cost: \$0.41 per kGal | | | | |

ELECTRICAL CONSUMPTION - FT. DRUM (WELLS, RESERVOIR PUMPS) & DANC

A full year of data taken from the telemetry system was taken from August to July.

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total | Reservoir Pump |
|--------------|-------------|------------|------------|-------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------------|
| Avg. (Hours) | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 55,000 | 2,614 |
| Flow (gpm) | 410 | 125 | 75 | 410 | 125 | 150 | 75 | 185 | 220 | 285 | 190 | 2,249 | 450 |
| Flow (gal) | 122,970,000 | 37,470,000 | 22,467,000 | 122,970,000 | 37,467,000 | 44,970,000 | 22,467,324 | 55,467,000 | 65,967,000 | 85,467,000 | 56,967,000 | 674,649,324 | |
| Motor HP | 40 | 20 | 15 | 40 | 15 | 15 | 15 | 20 | 25 | 40 | 30 | - | 40 |
| Motor Effic. | 89.5% | 87.5% | 86.0% | 89.5% | 86.0% | 86.0% | 86.0% | 87.5% | 88.0% | 89.5% | 88.5% | - | 89.5% |
| Motor kW | 25.0 | 12.8 | 9.8 | 25.0 | 9.8 | 9.8 | 9.8 | 12.8 | 15.9 | 25.0 | 19.0 | 174.49 | 25.0 |
| Motor kWh | 125,027.9 | 63,942.9 | 48,793.6 | 125,027.9 | 48,793.6 | 48,793.6 | 48,793.6 | 63,942.9 | 79,474.4 | 125,027.9 | 94,830.5 | 872,448.9 | 65,364.6 |
| kWh Cost | \$9,002 | \$4,604 | \$3,513 | \$9,002 | \$3,513 | \$3,513 | \$3,513 | \$4,604 | \$5,722 | \$9,002 | \$6,828 | \$62,816 | \$4,706 |

COST OF WATER - DISTRIBUTION SYSTEM - BASED ON 1995 WATER PRICES

Total O&M Cost: \$20,105 (Based on FY95 value supplied by Ft. Drum minus chemical treatment costs)
 Total Chemical Treatment Cost: \$20,769 (=5550 * Flow Rate/180,282,960)
 Avg. kW: 15.86
 Avg. gpm: 204.44

Total Well Operation (hrs): 55,000
 Total Well kWh Cost: \$62,816
 Total Well Production (gal): 674,649,324
 Cost of Drum Water (per kGal) \$0.093
 (Based on \$0.072/kWh)
 (Average value per year from Aug-93 to Jul-95)

Total Reservoir Pump (min.): 156,840
 Total Reservoir Pump Cost: \$4,706
 Total Reservoir Pump (gal): 70,578,000
 Cost of Res. Water (per kGal) \$0.067
 (Based on \$0.078/kWh)
 (Based on flow rate of 450 gpm)

DANC Production: 34,651,329
 Total DANC Cost (per kGal): \$0.90
 (Equal total usage of 709,300,653 minus well production)
 (Taken from Schedule "A" for 1995, only variable water costs were included)

| | DANC Water Cost / kGal | Ft. Drum Electrical Cost / kGal | O & M Cost / kGal | Ft. Drum Chem. Cost | Reservoir Pump Cost / kGal |
|-------------|-----------------------------|---------------------------------|---------------------|---------------------|----------------------------|
| Total Cost: | \$0.90 34,651 709,301 | \$0.093 674,649 709,301 | \$20,105 709,301 | \$20,769 674,649 | \$4,706 70,578 |
| Total Cost: | \$0.90 | \$0.093 | \$0.028 | \$0.031 | \$0.067 |
| Total Cost: | \$0.044 | \$0.089 | \$0.028 | \$0.031 | \$0.067 |
| Total Cost: | \$0.26 per kGal | | | | |

ELECTRICAL CONSUMPTION - FT. DRUM (WELLS, RESERVOIR PUMPS) & DANC

A full year of data taken from the telemetry system was taken from August to July.

| Date | Well No. 2 | Well No. 3 | Well No. 4 | Well No. 5 | Well No. 6 | Well No. 7 | Well No. 8 | Well No. 9 | Well No. 10 | Well No. 11 | Well No. 12 | Total | Reservoir Pump |
|--------------|-------------|------------|------------|-------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|----------------|
| Avg. (Hours) | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 57,200 | 2,614 |
| Flow (gpm) | 410 | 125 | 75 | 410 | 125 | 150 | 75 | 185 | 220 | 285 | 190 | 2,249 | 450 |
| Flow (gal) | 127,888,800 | 38,968,800 | 23,365,680 | 127,888,800 | 38,965,680 | 46,768,800 | 23,366,017 | 57,685,680 | 68,605,680 | 88,885,680 | 59,245,680 | 701,635,297 | |
| Motor HP | 40 | 20 | 15 | 40 | 15 | 15 | 15 | 20 | 25 | 40 | 30 | - | 40 |
| Motor Effic. | 89.5% | 87.5% | 86.0% | 89.5% | 86.0% | 86.0% | 86.0% | 87.5% | 88.0% | 89.5% | 88.5% | - | 89.5% |
| Motor kW | 25.0 | 12.8 | 9.8 | 25.0 | 9.8 | 9.8 | 9.8 | 12.8 | 15.9 | 25.0 | 19.0 | 174.49 | 25.0 |
| Motor kWh | 130,029.1 | 66,500.6 | 50,745.3 | 130,029.1 | 50,745.3 | 50,745.3 | 50,745.3 | 66,500.6 | 82,653.4 | 130,029.1 | 98,623.7 | 907,346.8 | 65,364.6 |
| kWh Cost | \$9,362 | \$4,788 | \$3,654 | \$9,362 | \$3,654 | \$3,654 | \$3,654 | \$4,788 | \$5,951 | \$9,362 | \$7,101 | \$65,329 | \$4,706 |

COST OF WATER - DISTRIBUTION SYSTEM - BASED ON 1995 WATER PRICES

Total O&M Cost: \$20,105
Total Chemical Treatment Cost: \$21,600
Total Well Operation (hrs): 57,200
Total Well kWh Cost: \$65,329
Total Well Production (gal): 701,635,297
Cost of Drum Water (per kGal) \$0.093

Avg. kW: 15.86

(Based on FY95 value supplied by Ft. Drum minus chemical treatment costs)
(=5550 * Flow Rate/180,282,960)

Avg. gpm: 204.44

(Based on \$0.072/kWh)

(Average value per year from Aug-93 to Jul-95)

(Based on \$0.078/kWh)

(Based on flow rate of 450 gpm)

(Equal total usage of 709,300,653 minus well production)

(Taken from Schedule "A" for 1995, only variable water costs were included)

| | DANC Water Cost / kGal | Ft. Drum Electrical Cost / kGal | O & M Cost/ kGal | Ft. Drum Chem. Cost | Reservoir Pump Cost/ kGal |
|-------------|------------------------|---------------------------------|------------------|---------------------|---------------------------|
| Total Cost: | \$0.90 | \$0.093 | \$20,105 | \$21,600 | \$4,706 |
| | 7,665 | 701,635 | 709,301 | 701,635 | 70,578 |
| | 709,301 | 709,301 | | | |
| Total Cost: | \$0.90 | \$0.093 | \$0.028 | \$0.031 | \$0.067 |
| | 1.08% | 98.92% | | | |
| Total Cost: | \$0.010 | \$0.092 | \$0.028 | \$0.031 | \$0.067 |
| Total Cost: | \$0.23 per kGal | | | | |

PRICE LIST - FT. DRUM WATER CONSERVATION STUDY

| Item | Unit of Measure | Material Unit Cost | Labor Unit Cost | Equipment Unit Cost | Comments |
|----------------------------|-----------------|--------------------|-----------------|---------------------|---|
| BACKFILL | CY | \$0.00 | \$0.71 | \$0.58 | Approx 2/3 CY per LF piping |
| BLIND FLANGE, 06" | EA | \$107.00 | \$112.00 | \$0.00 | 250 PSI |
| BLIND FLANGE, 08" | EA | \$163.00 | \$168.00 | \$0.00 | 250 PSI |
| BLIND FLANGE, 10" | EA | \$350.00 | \$198.00 | \$0.00 | 250 PSI |
| BLIND FLANGE, 12" | EA | \$470.00 | \$240.00 | \$0.00 | 250 PSI |
| BLIND FLANGE, 14" | EA | \$745.00 | \$240.00 | \$0.00 | 250 PSI |
| BLIND FLANGE, 16" | EA | \$865.00 | \$335.00 | \$0.00 | 250 PSI |
| BLIND FLANGE, 24" | EA | \$2,425.00 | \$675.00 | \$0.00 | 250 PSI |
| COMPACTION | CY | \$0.00 | \$0.86 | \$0.33 | Walk behind vibrating plate |
| CRUSHED ROCK BEDDING | CY | \$13.00 | \$3.43 | \$1.39 | For pipe bedding, hydrant leakage |
| DEWATERING | DAY | \$0.00 | \$71.00 | \$8.05 | 2" Diaphragm pump for 8 hours |
| ELBOW, 06" | EA | \$121.00 | \$21.50 | \$0.00 | |
| ELBOW, 08" | EA | \$197.00 | \$25.50 | \$0.00 | |
| ELBOW, 12" | EA | \$335.00 | \$36.00 | \$6.00 | |
| ELBOW, 14" | EA | \$540.00 | \$40.50 | \$6.75 | |
| ELBOW, 16" | EA | \$610.00 | \$46.00 | \$7.75 | |
| ELBOW, 24" | EA | \$1,400.00 | \$108.00 | \$18.05 | |
| EXCAVATION | CY | \$0.00 | \$1.56 | \$1.58 | Approx 2/3 CY per LF piping |
| GATE VALVE, 04" | EA | \$270.00 | \$108.00 | \$0.00 | Add \$100 matl/\$20 labor for valve box |
| GATE VALVE, 06" | EA | \$450.00 | \$135.00 | \$0.00 | With valve box |
| GATE VALVE, 08" | EA | \$755.00 | \$185.00 | \$31.00 | With valve box |
| GATE VALVE, 10" | EA | \$1,220.00 | \$216.00 | \$36.00 | With valve box |
| GATE VALVE, 12" | EA | \$1,695.00 | \$216.00 | \$36.00 | With valve box |
| GATE VALVE, 16" | EA | \$4,495.00 | \$645.00 | \$108.00 | With valve box |
| GATE VALVE, 24" | EA | \$12,070.00 | \$1,300.00 | \$217.00 | With valve box |
| HYDRANT | EA | \$1,250.00 | \$129.00 | \$21.50 | Add for three-way valve (7%) |
| HYDRANT DEMOLITION | EA | \$0.00 | \$102.00 | \$0.00 | |
| PATCH PIPE LEAK | EA | \$200.00 | \$130.00 | \$0.00 | Assume Crew B-20, 6 manhours |
| PAVEMENT REMOVAL, 3" THICK | SY | \$0.00 | \$1.30 | \$1.80 | |
| PIPE LINING, 06" | LF | \$16.95 | \$33.45 | \$0.96 | Sizes 6" - 10" |
| PIPE LINING, 10" | LF | \$20.85 | \$34.35 | \$1.00 | Sizes 10" - 12" |
| PIPE LINING, 12" | LF | \$21.75 | \$37.50 | \$1.08 | Sizes 12" - 16" |

PRICE LIST - FT. DRUM WATER CONSERVATION STUDY

| Item | Unit of Measure | Material Unit Cost | Labor Unit Cost | Equipment Unit Cost | Comments |
|----------------------------|-----------------|--------------------|-----------------|---------------------|------------------------------------|
| PIPE LINING, 16" | LF | \$22.95 | \$44.55 | \$1.29 | Sizes 16" - 20" |
| PIPE LINING, 24" | LF | \$27.45 | \$48.15 | \$1.41 | Sizes 24" - 36" |
| PIPE REMOVAL, 24" DIAMETER | LF | \$0.00 | \$4.29 | \$1.73 | |
| PIPE REMOVAL, 36" DIAMETER | LF | \$0.00 | \$5.70 | \$2.31 | |
| PIPE REMOVAL, TO 12" DIA. | LF | \$0.00 | \$3.43 | \$1.39 | |
| PIPING, 06" | LF | \$8.45 | \$4.29 | \$0.00 | |
| PIPING, 08" | LF | \$11.15 | \$6.00 | \$1.00 | |
| PIPING, 12" | LF | \$18.50 | \$9.00 | \$1.51 | |
| PIPING, 14" | LF | \$23.00 | \$12.00 | \$2.01 | |
| PIPING, 16" | LF | \$25.50 | \$14.05 | \$2.36 | |
| PIPING, 24" | LF | \$45.50 | \$19.45 | \$4.51 | |
| TEE, 06" | EA | \$182.00 | \$32.00 | \$0.00 | |
| TEE, 08" | EA | \$258.00 | \$38.50 | \$0.00 | |
| TEE, 14" | EA | \$655.00 | \$64.50 | \$10.85 | |
| TEE, 16" | EA | \$920.00 | \$81.00 | \$13.55 | |
| TEE, 24" | EA | \$2,125.00 | \$216.00 | \$36.00 | |
| THRUST BLOCK | CY | \$81.50 | \$110.10 | \$0.00 | |
| VALVE DEMOLITION, TO 16" | EA | \$0.00 | \$50.00 | \$0.00 | Includes valve box demo |
| VALVE DEMOLITION, TO 8" | EA | \$0.00 | \$30.00 | \$0.00 | Includes valve box demo |
| WELDING METAL PIPE | MAN-HR | \$3.00 | \$30.00 | \$9.90 | Cost per welder. Assume 2 welders. |

*Note: Pipe lining costs include costs for pipe cleaning, protection of connections, lining placement, curing & protection of lining, and access openings

City Cost Indexes

| DIVISION | | NEW YORK | | | | | | | | | | | | | | | | | | | | |
|----------|--------------------------------------|----------------|-------|-------|------------|-------|-------|--------------|-------|-------|--------------|-------|-------|-----------|-------|--------|----------------|-------|-------|--|--|--|
| | | BUFFALO | | | HICKSVILLE | | | NEW YORK | | | RIVERHEAD | | | ROCHESTER | | | SCHENECTADY | | | | | |
| | | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | | | |
| 2 | SITE WORK | 100.7 | 95.1 | 96.4 | 119.2 | 134.0 | 130.6 | 141.1 | 134.2 | 135.8 | 119.5 | 134.0 | 130.7 | 75.9 | 110.4 | 102.4 | 74.9 | 110.4 | 102.2 | | | |
| 031 | CONCRETE FORMWORK | 106.6 | 121.3 | 119.1 | 90.7 | 162.6 | 151.7 | 110.7 | 171.3 | 162.1 | 95.7 | 157.2 | 147.9 | 105.5 | 107.0 | 106.7 | 107.9 | 96.8 | 98.5 | | | |
| 032 | CONCRETE REINFORCEMENT | 103.3 | 118.4 | 111.8 | 100.0 | 194.4 | 153.0 | 100.0 | 203.0 | 157.8 | 101.9 | 194.3 | 153.8 | 104.2 | 104.4 | 104.3 | 98.6 | 104.5 | 101.9 | | | |
| 033 | CAST IN PLACE CONCRETE | 104.9 | 124.1 | 113.1 | 101.5 | 153.3 | 123.6 | 129.1 | 156.9 | 141.0 | 99.7 | 153.3 | 122.6 | 95.9 | 113.5 | 103.4 | 99.7 | 107.1 | 102.9 | | | |
| 3 | CONCRETE | 103.5 | 120.5 | 112.1 | 107.6 | 163.7 | 135.9 | 131.9 | 170.4 | 151.3 | 106.7 | 161.3 | 134.3 | 108.4 | 109.5 | 109.0 | 109.0 | 103.0 | 106.0 | | | |
| 4 | MASONRY | 110.4 | 126.4 | 120.4 | 117.4 | 167.5 | 148.5 | 118.1 | 177.9 | 155.3 | 125.3 | 167.5 | 151.5 | 106.3 | 113.3 | 110.6 | 98.2 | 105.1 | 102.5 | | | |
| 5 | METALS | 99.4 | 100.7 | 99.9 | 108.9 | 145.4 | 122.7 | 111.8 | 149.7 | 126.2 | 109.0 | 145.4 | 122.7 | 102.6 | 117.5 | 108.3 | 99.8 | 118.2 | 106.8 | | | |
| 6 | WOOD & PLASTICS | 109.2 | 122.4 | 115.8 | 92.7 | 165.5 | 129.1 | 116.8 | 173.1 | 145.0 | 98.4 | 158.2 | 128.3 | 105.3 | 106.5 | 105.9 | 113.1 | 95.0 | 104.1 | | | |
| 7 | THERMAL & MOISTURE PROTECTION | 103.2 | 114.9 | 108.6 | 106.4 | 152.3 | 127.6 | 107.0 | 162.5 | 132.6 | 106.5 | 151.6 | 127.3 | 98.7 | 111.2 | 104.5 | 92.1 | 101.4 | 96.4 | | | |
| 8 | DOORS & WINDOWS | 92.6 | 115.0 | 98.0 | 91.0 | 169.1 | 109.8 | 98.2 | 177.1 | 117.2 | 91.0 | 165.2 | 108.8 | 97.9 | 102.7 | 99.1 | 98.0 | 92.8 | 96.7 | | | |
| 092 | LATH, PLASTER & GYPSUM BOARD | 105.6 | 122.4 | 116.5 | 99.3 | 167.6 | 143.6 | 116.2 | 175.4 | 154.5 | 101.1 | 160.0 | 139.3 | 103.7 | 106.3 | 105.4 | 110.5 | 94.5 | 100.1 | | | |
| 095 | ACOUSTICAL TREATMENT & WOOD FLOORING | 92.9 | 122.4 | 112.0 | 81.6 | 167.6 | 137.3 | 105.4 | 175.4 | 150.7 | 81.6 | 160.0 | 132.4 | 95.9 | 106.3 | 102.7 | 97.7 | 94.5 | 95.6 | | | |
| 096 | FLOORING & CARPET | 92.3 | 120.9 | 99.1 | 90.8 | 120.3 | 97.9 | 95.1 | 158.8 | 110.4 | 92.2 | 120.3 | 98.9 | 80.8 | 114.6 | 88.9 | 82.3 | 95.9 | 85.5 | | | |
| 099 | PAINTING & WALL COVERINGS | 79.5 | 118.9 | 102.4 | 102.8 | 153.6 | 132.4 | 100.3 | 146.9 | 127.4 | 102.8 | 153.6 | 132.4 | 76.5 | 109.6 | 95.8 | 80.0 | 85.6 | 83.3 | | | |
| 9 | FINISHES | 95.7 | 121.9 | 109.1 | 105.4 | 153.2 | 129.8 | 112.7 | 166.3 | 140.0 | 106.0 | 148.9 | 127.9 | 96.3 | 108.9 | 102.7 | 96.3 | 94.9 | 95.6 | | | |
| 10-14 | TOTAL DIV. 10-14 | 100.0 | 110.4 | 102.2 | 100.0 | 140.3 | 108.6 | 100.0 | 150.2 | 110.7 | 100.0 | 139.3 | 108.4 | 100.0 | 104.8 | 101.0 | 100.0 | 97.9 | 99.6 | | | |
| 15 | MECHANICAL | 100.1 | 102.0 | 100.9 | 100.0 | 153.9 | 123.8 | 100.2 | 168.1 | 130.2 | 100.0 | 153.9 | 123.8 | 100.1 | 99.8 | 99.9 | 100.3 | 96.1 | 98.4 | | | |
| 16 | ELECTRICAL | 101.3 | 103.0 | 102.4 | 105.2 | 158.4 | 140.7 | 115.2 | 165.9 | 149.0 | 106.4 | 158.4 | 141.1 | 106.8 | 97.3 | 100.5 | 105.4 | 101.9 | 103.1 | | | |
| 1-16 | WEIGHTED AVERAGE | 99.9 | 109.8 | 104.7 | 103.7 | 154.7 | 128.4 | 110.4 | 163.4 | 136.1 | 104.3 | 153.6 | 128.1 | 100.9 | 106.4 | 103.6 | 100.0 | 102.2 | 101.1 | | | |
| DIVISION | | NEW YORK | | | | | | | | | | | | | | | NORTH CAROLINA | | | | | |
| | | SYRACUSE | | | UTICA | | | WATERTOWN | | | WHITE PLAINS | | | YONKERS | | | ASHEVILLE | | | | | |
| | | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | | | |
| 2 | SITE WORK | 97.9 | 110.0 | 107.2 | 72.9 | 109.3 | 100.9 | 81.8 | 111.8 | 104.9 | 129.7 | 134.0 | 133.0 | 140.8 | 133.5 | 135.2 | 104.1 | 72.9 | 80.1 | | | |
| 031 | CONCRETE FORMWORK | 106.7 | 92.0 | 94.2 | 107.8 | 83.6 | 87.2 | 84.9 | 94.6 | 93.1 | 111.7 | 140.5 | 136.1 | 110.5 | 140.4 | 135.9 | 93.3 | 52.5 | 58.7 | | | |
| 032 | CONCRETE REINFORCEMENT | 99.9 | 99.7 | 99.8 | 99.9 | 90.0 | 94.4 | 100.4 | 84.3 | 91.4 | 93.8 | 178.1 | 141.1 | 97.5 | 129.0 | 115.2 | 95.3 | 47.8 | 68.6 | | | |
| 033 | CAST IN PLACE CONCRETE | 99.7 | 99.4 | 99.6 | 92.1 | 98.0 | 94.7 | 107.3 | 104.2 | 106.0 | 113.8 | 143.0 | 126.2 | 127.3 | 143.1 | 134.0 | 100.1 | 58.0 | 82.1 | | | |
| 3 | CONCRETE | 107.1 | 97.4 | 102.2 | 105.6 | 91.4 | 98.4 | 118.7 | 97.2 | 107.9 | 118.5 | 147.7 | 133.3 | 130.9 | 139.3 | 135.1 | 101.0 | 55.7 | 78.1 | | | |
| 4 | MASONRY | 104.8 | 95.0 | 98.7 | 96.9 | 93.2 | 94.6 | 98.0 | 101.7 | 100.3 | 111.5 | 151.5 | 136.3 | 117.7 | 151.8 | 138.9 | 80.0 | 44.2 | 57.8 | | | |
| 5 | METALS | 99.7 | 114.5 | 105.3 | 98.0 | 111.0 | 102.9 | 98.0 | 109.5 | 102.4 | 101.7 | 142.9 | 117.3 | 108.9 | 142.7 | 121.7 | 93.9 | 85.1 | 90.6 | | | |
| 6 | WOOD & PLASTICS | 113.1 | 90.6 | 101.8 | 113.1 | 81.2 | 97.1 | 87.1 | 93.5 | 90.3 | 119.1 | 136.5 | 127.8 | 117.4 | 136.5 | 127.0 | 93.0 | 53.6 | 73.3 | | | |
| 7 | THERMAL & MOISTURE PROTECTION | 99.8 | 98.1 | 99.0 | 92.1 | 96.2 | 94.0 | 92.2 | 100.7 | 96.1 | 107.7 | 144.6 | 124.8 | 108.1 | 148.2 | 126.6 | 93.6 | 50.4 | 73.7 | | | |
| 8 | DOORS & WINDOWS | 96.1 | 89.0 | 94.4 | 98.0 | 78.8 | 93.3 | 98.0 | 84.8 | 94.8 | 94.5 | 153.5 | 108.7 | 98.3 | 155.4 | 112.0 | 93.9 | 50.6 | 83.5 | | | |
| 092 | LATH, PLASTER & GYPSUM BOARD | 110.5 | 89.8 | 97.1 | 110.5 | 80.2 | 90.9 | 101.3 | 92.9 | 95.9 | 112.3 | 137.6 | 128.7 | 115.8 | 137.6 | 130.0 | 93.8 | 51.9 | 66.7 | | | |
| 095 | ACOUSTICAL TREATMENT & WOOD FLOORING | 97.7 | 89.8 | 92.6 | 97.7 | 80.2 | 86.4 | 97.7 | 92.9 | 94.6 | 86.3 | 137.6 | 119.5 | 103.9 | 137.6 | 125.7 | 87.1 | 51.9 | 64.3 | | | |
| 096 | FLOORING & CARPET | 84.4 | 85.0 | 84.6 | 82.3 | 89.5 | 84.0 | 75.1 | 89.5 | 78.6 | 91.2 | 158.8 | 107.4 | 90.8 | 158.8 | 107.1 | 84.1 | 52.8 | 76.6 | | | |
| 099 | PAINTING & WALL COVERINGS | 85.2 | 90.3 | 88.2 | 80.0 | 90.3 | 86.0 | 80.0 | 83.9 | 82.3 | 97.4 | 135.3 | 119.5 | 97.4 | 135.3 | 119.5 | 102.7 | 51.8 | 73.1 | | | |
| 9 | FINISHES | 97.9 | 89.9 | 93.9 | 96.3 | 84.8 | 90.5 | 93.3 | 92.1 | 92.7 | 106.4 | 142.4 | 124.7 | 110.7 | 142.5 | 126.9 | 88.7 | 52.3 | 70.2 | | | |
| 10-14 | TOTAL DIV. 10-14 | 100.0 | 97.5 | 99.5 | 100.0 | 93.6 | 98.6 | 100.0 | 84.7 | 96.8 | 100.0 | 136.4 | 107.7 | 100.0 | 143.2 | 109.2 | 100.0 | 74.0 | 94.5 | | | |
| 15 | MECHANICAL | 100.3 | 96.4 | 98.6 | 100.3 | 92.5 | 96.8 | 100.3 | 96.5 | 98.6 | 100.3 | 136.8 | 116.4 | 100.3 | 137.5 | 116.7 | 100.1 | 57.7 | 81.3 | | | |
| 16 | ELECTRICAL | 105.4 | 91.7 | 96.3 | 105.4 | 85.5 | 92.1 | 105.4 | 87.2 | 93.3 | 98.9 | 140.9 | 126.9 | 112.8 | 157.5 | 142.6 | 99.5 | 56.8 | 71.0 | | | |
| 1-16 | WEIGHTED AVERAGE | 101.0 | 97.6 | 99.4 | 99.2 | 93.2 | 96.3 | 100.5 | 97.1 | 98.9 | 104.4 | 142.1 | 122.6 | 109.5 | 144.2 | 126.3 | 96.0 | 59.3 | 78.3 | | | |
| DIVISION | | NORTH CAROLINA | | | | | | | | | | | | | | | | | | | | |
| | | CHARLOTTE | | | DURHAM | | | FAYETTEVILLE | | | GREENSBORO | | | RALEIGH | | | WILMINGTON | | | | | |
| | | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | MAT. | INST. | TOTAL | | | |
| 2 | SITE WORK | 104.4 | 72.9 | 80.2 | 104.3 | 82.8 | 87.8 | 102.4 | 82.8 | 87.3 | 104.1 | 82.8 | 87.7 | 104.6 | 82.8 | 87.8 | 105.2 | 73.0 | 80.4 | | | |
| 031 | CONCRETE FORMWORK | 102.6 | 52.5 | 60.1 | 95.4 | 52.6 | 59.1 | 90.3 | 52.6 | 58.3 | 95.4 | 52.6 | 59.1 | 98.8 | 52.6 | 59.6 | 95.2 | 52.6 | 59.1 | | | |
| 032 | CONCRETE REINFORCEMENT | 95.7 | 47.8 | 68.8 | 95.7 | 54.5 | 72.6 | 94.8 | 54.5 | 72.1 | 95.7 | 54.5 | 72.6 | 95.7 | 54.5 | 72.6 | 96.0 | 54.5 | 72.7 | | | |
| 033 | CAST IN PLACE CONCRETE | 101.3 | 58.1 | 82.9 | 100.3 | 58.1 | 82.3 | 96.8 | 58.1 | 80.3 | 99.4 | 58.1 | 81.8 | 103.3 | 58.1 | 84.0 | 99.6 | 58.1 | 81.9 | | | |
| 3 | CONCRETE | 101.6 | 55.8 | 78.5 | 100.6 | 57.1 | 78.6 | 98.0 | 57.1 | 77.3 | 100.1 | 57.1 | 78.4 | 102.2 | 57.1 | 79.4 | 100.9 | 57.1 | 78.7 | | | |
| 4 | MASONRY | 81.0 | 44.2 | 58.1 | 79.5 | 44.2 | 57.6 | 83.9 | 44.2 | 59.2 | 79.5 | 44.2 | 57.5 | 86.4 | 44.2 | 60.2 | 69.0 | 44.2 | 53.6 | | | |
| 5 | METALS | 95.2 | 85.2 | 91.4 | 95.2 | 87.8 | 92.4 | 94.1 | 87.8 | 91.8 | 96.0 | 87.8 | 92.9 | 95.3 | 87.8 | 92.4 | 94.2 | 87.8 | 91.8 | | | |
| 6 | WOOD & PLASTICS | 103.6 | 53.6 | 78.6 | 94.7 | 53.6 | 74.1 | 89.3 | 53.6 | 71.4 | 94.7 | 53.6 | 74.1 | 99.0 | 53.6 | 76.3 | 95.2 | 53.6 | 74.4 | | | |
| 7 | THERMAL & MOISTURE PROTECTION | 94.0 | 51.6 | 74.5 | 94.2 | 51.1 | 74.3 | 93.8 | 51.1 | 74.1 | 94.2 | 51.1 | 74.3 | 94.0 | 50.4 | 73.9 | 93.6 | 51.1 | 74.0 | | | |
| 8 | DOORS & WINDOWS | 98.0 | 50.6 | 86.6 | 98.0 | 52.9 | 87.1 | 94.1 | 52.9 | 84.1 | 98.0 | 52.9 | 87.1 | 94.8 | 52.9 | 84.7 | 94.1 | 52.9 | 84.2 | | | |
| 092 | LATH, PLASTER & GYPSUM BOARD | 98.3 | 51.9 | 68.2 | 98.3 | 51.9 | 68.2 | 94.2 | 51.9 | 66.8 | 98.3 | 51.9 | 68.2 | 98.3 | 51.9 | 68.2 | 94.7 | 51.9 | 67.0 | | | |
| 095 | ACOUSTICAL TREATMENT & WOOD FLOORING | 91.5 | 51.9 | 65.8 | 91.5 | 51.9 | 65.8 | 88.5 | 51.9 | 64.8 | 91.5 | 51.9 | 65.8 | 91.5 | 51.9 | 65.8 | 88.5 | 51.9 | 64.8 | | | |
| 096 | FLOORING & CARPET | 87.3 | 52.8 | 79.0 | 87.3 | 52.8 | 79.0 | 84.2 | 52.8 | 76.7 | 87.3 | 52.8 | 79.0 | 87.3 | 52.8 | 79.0 | 84.8 | 52.8 | 77.1 | | | |
| 099 | PAINTING & WALL COVERINGS | 102.7 | 51.8 | 73.1 | 102.7 | 51.8 | 73.1 | 102.7 | 51.8 | 73.1 | 102.7 | 51.8 | 73.1 | 102.7 | 51.8 | 73.1</ | | | | | | |

020 | Subsurface Investigation & Demolition

| 020 120 Std Penetration Tests | | | | | | 1996 BARE COSTS | | | | TOTAL | |
|---------------------------------|--|--|--|-------------|--------|-----------------|-------|--------|--------|----------|-----|
| | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | MAT. | LABOR | EQUIP. | TOTAL | INCL O&P | |
| 125 | 2050 | 6" diameter core | B-89A | 6.40 | 2.500 | Total | 57 | 8.65 | 65.65 | 101 | |
| | 2100 | 8" diameter core | | 5.80 | 2.759 | | 63 | 9.50 | 72.50 | 112 | |
| | 2150 | 10" diameter core | | 5 | 3.200 | | 73 | 11.05 | 84.05 | 129 | |
| | 2200 | 12" diameter core | | 4.10 | 3.902 | | 89.50 | 13.45 | 102.95 | 158 | |
| | 2250 | 14" diameter core | | 3.55 | 4.507 | | 103 | 15.55 | 118.55 | 182 | |
| | 2300 | 18" diameter core | | 3.30 | 4.848 | | 111 | 16.75 | 127.75 | 195 | |
| | 3010 | Bits for core drill, diamond, premium, 1" diameter | | | | Ea. | 145 | | 145 | 160 | |
| | 3040 | 4" diameter | | | | | 375 | | 375 | 415 | |
| | 3080 | 8" diameter | | | | | 750 | | 750 | 825 | |
| | 3120 | 12" diameter | | | | | 1,000 | | 1,000 | 1,100 | |
| | 3180 | 18" diameter | | | | | 1,575 | | 1,575 | 1,750 | |
| | 3240 | 24" diameter | | | | | 2,250 | | 2,250 | 2,475 | |
| 128 | 0010 | TEST PITS Hand digging, light soil | 1 Clab | 4.50 | 1.778 | C.Y. | 35 | | 35 | 56 | |
| | 0100 | Heavy soil | " | 2.50 | 3.200 | | 63.50 | | 63.50 | 101 | |
| | 0120 | Loader-backhoe, light soil | B-11M | 28 | .571 | | 13 | 10.20 | 23.20 | 32 | |
| | 0130 | Heavy soil | " | 20 | .800 | | 18.20 | 14.30 | 32.50 | 44 | |
| | 1000 | Subsurface exploration, mobilization | | | | Mile | | | 4.75 | 5.45 | |
| | 1010 | Difficult access for rig, add | | | | Hr. | | | 95 | 110 | |
| | 1020 | Auger borings, drill rig, incl. samples | | | | LF. | | | 11.25 | 12.95 | |
| | 1030 | Hand auger | | | | | | | 16.85 | 19.45 | |
| | 1050 | Drill and sample every 5', split spoon | | | | | | | 14.95 | 16.35 | |
| | 1060 | Extra samples | | | | Ea. | | | 19.45 | 20.80 | |
| | 020 550 Site Demolition | | | | | | | | | | |
| | 554 | 0010 | SITE DEMOLITION No hauling, abandon catch basin or manhole | B-6 | 7 | 3.429 | Ea. | 73.50 | 29.50 | 103 | 149 |
| 0020 | | Remove existing catch basin or manhole | | 4 | 6 | | 129 | 52 | 181 | 259 | |
| 0030 | | Catch basin or manhole frames and covers stored | | 13 | 1.846 | | 39.50 | 16 | 55.50 | 80 | |
| 0040 | | Remove and reset | | 7 | 3.429 | | 73.50 | 29.50 | 103 | 149 | |
| 0100 | | Roadside delineators, remove only | B-80 | 175 | .183 | | 3.96 | 2.64 | 6.60 | 9.10 | |
| 0110 | | Remove and reset | " | 100 | .320 | | 6.95 | 4.61 | 11.56 | 15.95 | |
| 0600 | | Fencing, barbed wire, 3 strand | 2 Clab | 430 | .037 | LF. | .74 | | .74 | 1.18 | |
| 0650 | | 5 strand | " | 280 | .057 | | 1.13 | | 1.13 | 1.81 | |
| 0700 | | Chain link, remove only, 8' to 10' high | B-6 | 445 | .054 | | 1.16 | .47 | 1.63 | 2.33 | |
| 0750 | | Remove and reset | | 70 | .343 | | 7.35 | 2.97 | 10.32 | 14.80 | |
| 0755 | | Remove only, 6' high | | 520 | .046 | | .99 | .40 | 1.39 | 2 | |
| 0756 | | Remove and reset | | 84 | .286 | | 6.10 | 2.47 | 8.57 | 12.35 | |
| 0757 | | Farm field fence (ASTM A116), remove only | B-1 | 500 | .048 | | .98 | | .98 | 1.57 | |
| 0760 | | Wood to 6' remove only, minimum | 2 Clab | 500 | .032 | | .63 | | .63 | 1.01 | |
| 0770 | | Maximum | | 250 | .064 | | 1.27 | | 1.27 | 2.02 | |
| 0775 | | Fencing, wood, all types, 4' to 6' high | | 432 | .037 | | .73 | | .73 | 1.17 | |
| 0780 | | Fence post, wood, 4" x 4", 6' to 8' high | | 96 | .167 | Ea. | 3.30 | | 3.30 | 5.25 | |
| 0785 | | Fence rail, 2" x 4", 8' long | | 7,680 | .002 | LF. | .04 | | .04 | .07 | |
| 0790 | | Remove and store | B-80 | 235 | .136 | | 2.95 | 1.96 | 4.91 | 6.80 | |
| 0800 | | Guide rail, corrugated steel, remove only | 2 Clab | 85 | .188 | | 3.73 | | 3.73 | 5.95 | |
| 0850 | | Remove and reset | " | 35 | .457 | | 9.05 | | 9.05 | 14.45 | |
| 0860 | | Guide posts, remove only | B-55 | 90 | .267 | Ea. | 5.35 | 6.85 | 12.20 | 15.95 | |
| 0870 | | Remove and reset | " | 50 | .480 | | 9.60 | 12.35 | 21.95 | 29 | |
| 0900 | | Hydrants, fire, remove only | 2 Plum | 4.70 | 3.404 | | 102 | | 102 | 157 | |
| 0950 | | Remove and reset | " | 1.40 | 11.429 | | 345 | | 345 | 525 | |
| 1000 | | Masonry walls, block or tile, solid, remove | B-5 | 1,800 | .036 | C.F. | .80 | .54 | 1.34 | 1.85 | |
| 1100 | | Cavity wall | | 2,200 | .029 | | .65 | .44 | 1.09 | 1.51 | |
| 1200 | | Brick, solid | | 900 | .071 | | 1.60 | 1.08 | 2.68 | 3.70 | |
| 1300 | With block back-up | | 1,130 | .057 | | 1.27 | .86 | 2.13 | 2.94 | | |
| 1400 | Stone, with mortar | | 900 | .071 | | 1.60 | 1.08 | 2.68 | 3.70 | | |
| 1500 | Dry set | | 1,500 | .043 | | .96 | .65 | 1.61 | 2.22 | | |
| 1600 | Median barrier, precast concrete, remove and store | B-3 | 430 | .112 | LF. | 2.39 | 3.90 | 6.29 | 8.05 | | |

SITE WORK 2

020 | Subsurface Investigation & Demolition

2 SITE WORK

| 020 550 Site Demolition | | | | | | 1996 BARE COSTS | | | | TOTAL |
|-------------------------------|------|---|--------------|-------------|------|-----------------|-------|--------|-------|----------|
| | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | MAT. | LABOR | EQUIP. | TOTAL | INCL O&P |
| 554 | 1610 | B-3 | 390 | .123 | L.F. | | 2.64 | 4.30 | 6.94 | 8.85 |
| | 1710 | B-38 | 690 | .058 | S.Y. | | 1.30 | 1.80 | 3.10 | 4.01 |
| | 1750 | | 420 | .095 | | | 2.13 | 2.96 | 5.09 | 6.60 |
| | 1800 | | 680 | .059 | | | 1.32 | 1.83 | 3.15 | 4.07 |
| | 1900 | | 255 | .157 | | | 3.51 | 4.87 | 8.38 | 10.85 |
| | 2000 | | 200 | .200 | | | 4.47 | 6.20 | 10.67 | 13.85 |
| | 2100 | | 33 | 1.212 | C.Y. | | 27 | 37.50 | 64.50 | 84 |
| | 2200 | | 24 | 1.667 | " | | 37.50 | 52 | 89.50 | 116 |
| | 2210 | 2 Clab | 1,066 | .015 | S.F. | | .30 | | .30 | .47 |
| | 2220 | 1 Carp | 1,000 | .008 | " | | .20 | | .20 | .32 |
| | 2230 | | 320 | .025 | | | .63 | | .63 | 1.01 |
| | 2240 | | 53 | .151 | Ea. | | 3.80 | | 3.80 | 6.10 |
| | 2300 | B-39 | 1,900 | .025 | S.F. | | .53 | .08 | .61 | .93 |
| | 2320 | | 1,200 | .040 | " | | .84 | .13 | .97 | 1.47 |
| | 2340 | | 830 | .058 | | | 1.21 | .18 | 1.39 | 2.12 |
| | 2360 | | 765 | .063 | | | 1.31 | .20 | 1.51 | 2.30 |
| | 2400 | B-6 | 325 | .074 | L.F. | | 1.58 | .64 | 2.22 | 3.19 |
| | 2500 | | 220 | .109 | " | | 2.34 | .94 | 3.28 | 4.72 |
| | 2600 | | 355 | .068 | | | 1.45 | .59 | 2.04 | 2.92 |
| | 2700 | | 830 | .029 | | | .62 | .25 | .87 | 1.26 |
| | 2800 | | 570 | .042 | | | .90 | .36 | 1.26 | 1.82 |
| | 2900 | | 175 | .137 | | | 2.94 | 1.19 | 4.13 | 5.95 |
| | 2930 | | 150 | .160 | | | 3.43 | 1.39 | 4.82 | 6.90 |
| | 2960 | | 120 | .200 | | | 4.29 | 1.73 | 6.02 | 8.65 |
| | 3000 | | 90 | .267 | | | 5.70 | 2.31 | 8.01 | 11.55 |
| | 3200 | | 160 | .150 | | | 3.21 | 1.30 | 4.51 | 6.50 |
| | 3300 | | 80 | .300 | | | 6.45 | 2.60 | 9.05 | 12.95 |
| | 3500 | B-14 | 110 | .436 | | | 9.15 | 1.89 | 11.04 | 16.60 |
| | 3600 | | 500 | .096 | C.Y. | | 2.01 | .42 | 2.43 | 3.65 |
| | 3700 | | 50 | .960 | L.F. | | 20 | 4.16 | 24.16 | 36.50 |
| | 3800 | | 1 | .48 | Ea. | | 1,000 | 208 | 1,208 | 1,825 |
| | 4000 | B-6 | 325 | .074 | S.Y. | | 1.58 | .64 | 2.22 | 3.19 |
| | 4050 | | 185 | .130 | | | 2.78 | 1.12 | 3.90 | 5.60 |
| | 4060 | | 270 | .089 | | | 1.90 | .77 | 2.67 | 3.85 |
| | 4100 | | 160 | .150 | | | 3.21 | 1.30 | 4.51 | 6.50 |
| | 4200 | | 150 | .160 | | | 3.43 | 1.39 | 4.82 | 6.90 |
| | 5000 | B-5 | 45 | 1.422 | C.Y. | | 32 | 21.50 | 53.50 | 73.50 |
| | 5100 | | 33 | 1.939 | " | | 43.50 | 29.50 | 73 | 101 |
| | 5200 | | 25 | 2.560 | " | | 57.50 | 39 | 96.50 | 133 |
| | 5500 | | | | | | | | 200% | 200% |
| | 5550 | B-11A | 232 | .069 | | | 1.57 | 3.68 | 5.25 | 6.50 |
| | 5600 | B-34D | 76 | .105 | | | 2.18 | 6.85 | 9.03 | 10.90 |
| 020 600 Building Demolition | | | | | | | | | | |
| 604 | 0010 | BUILDING DEMOLITION Large urban projects, incl. 20 Mi. haul | | | | | | | | |
| | 0012 | B-8 | 21,500 | .003 | C.F. | | .07 | .10 | .17 | 21 |
| | 0050 | | 15,300 | .004 | | | .09 | .14 | .23 | 30 |
| | 0080 | | 20,100 | .003 | | | .07 | .11 | .18 | 23 |
| | 0100 | | 20,100 | .003 | | | .07 | .11 | .18 | 23 |
| | 0500 | B-3 | 14,800 | .003 | | | .07 | .11 | .18 | 23 |
| | 0600 | | 11,300 | .004 | | | .09 | .15 | .24 | 30 |
| | 0650 | | 14,800 | .003 | | | .07 | .11 | .18 | 23 |
| | 0700 | | 14,800 | .003 | | | .07 | .11 | .18 | 23 |
| | 1000 | | | | Ea. | | | | 2,050 | 2,250 |
| | 1020 | | | | | | | | 3,500 | 3,825 |
| | 1200 | | | | | | | | 2,325 | 2,550 |

021 | Site Preparation & Excavation Support

2 SITE WORK

| 021 140 Stripping | | CREW | DAILY OUTPUT | LABOR HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL INCL O&P |
|------------------------------|------|--------|--------------|-------------|-------|-----------------|-------|--------|--------|----------------|
| | | | | | | MAT. | LABOR | EQUIP. | TOTAL | |
| 144 | 0500 | B-10X | 2,000 | .006 | C.Y. | | .14 | .65 | .79 | .94 |
| | 0600 | B-10B | 1,600 | .008 | | | .18 | .53 | .71 | .87 |
| | 0601 | | 1,600 | .008 | | | .18 | .53 | .71 | .87 |
| | 0700 | | 800 | .015 | | | .36 | 1.07 | 1.43 | 1.72 |
| | 1000 | B-10M | 2,000 | .006 | | | .14 | .56 | .70 | .83 |
| | 1100 | | 1,100 | .011 | | | .26 | 1.01 | 1.27 | 1.51 |
| | 1200 | B-10X | 2,600 | .005 | | | .11 | .50 | .61 | .72 |
| | 1300 | | 1,340 | .009 | | | .21 | .98 | 1.19 | 1.40 |
| 021 150 Selective Clearing | | | | | | | | | | |
| 154 | 0010 | | | | | | | | | |
| | 1000 | | | | | | | | | |
| | 1040 | B-17 | 60 | .533 | Ea. | | 11.35 | 9.30 | 20.65 | 28 |
| | 1050 | B-30 | 33 | .727 | | | 16.25 | 47.50 | 63.75 | 77.50 |
| | 1100 | | 25 | .960 | | | 21.50 | 63 | 84.50 | 102 |
| | 1150 | | 16 | 1.500 | | | 33.50 | 98 | 131.50 | 160 |
| | 1151 | | 16 | 1.500 | | | 33.50 | 98 | 131.50 | 160 |
| | 2000 | | | | | | | | | |
| | 2050 | B-7 | 18 | 2.667 | Ea. | | 56.50 | 62.50 | 119 | 158 |
| | 2100 | | 12 | 4 | | | 84.50 | 94 | 178.50 | 237 |
| | 2150 | | 10 | 4.800 | | | 101 | 113 | 214 | 285 |
| | 2200 | | 8 | 6 | | | 127 | 141 | 268 | 355 |
| | 2300 | | | | | | | | 150 | 225 |
| 021 200 Structure Moving | | | | | | | | | | |
| 204 | 0010 | | | | | | | | | |
| | 0020 | | | | Total | | | | | 8,700 |
| | 0040 | B-4 | 185 | .259 | S.F. | | 5.25 | 2.44 | 7.69 | 11.05 |
| | 0060 | | 137 | .350 | | | 7.10 | 3.29 | 10.39 | 14.90 |
| | 0200 | | | | | | | | | 15% |
| | 0220 | B-4 | 1 | 48 | Day | | 975 | 450 | 1,425 | 2,050 |
| | 0240 | | | | | | | | | |
| | 0300 | B-3 | 155 | .310 | S.F. | 5.50 | 6.65 | 10.80 | 22.95 | 28.50 |
| 021 400 Dewatering | | | | | | | | | | |
| 404 | 0010 | B-11C | 90 | .178 | C.Y. | | 4.04 | 2.31 | 6.35 | 8.85 |
| | 0100 | | 135 | .119 | | | 2.70 | 1.54 | 4.24 | 5.90 |
| | 0200 | 1 Clab | 7.10 | 1.127 | | | 22.50 | | 22.50 | 35.50 |
| | 0300 | | 3.50 | 2.286 | | | 45.50 | | 45.50 | 72 |
| | 0500 | | | | | | | | | |
| | 0550 | | | | | | | | | |
| | 0600 | B-10H | 4 | 3 | Day | | 71 | 8.05 | 79.05 | 120 |
| | 0620 | | | | | | | 30 | 30 | 33 |
| | 0650 | B-10I | 4 | 3 | | | 71 | 21 | 92 | 134 |
| | 0670 | | | | | | | 65 | 65 | 71 |
| | 0800 | B-10H | 1 | 12 | | | 285 | 32 | 317 | 475 |
| | 0820 | | | | | | | 32 | 32 | 35 |
| | 0900 | B-10J | 1 | 12 | | | 285 | 49.50 | 334.50 | 495 |
| | 0920 | | | | | | | 41 | 41 | 45 |
| | 1000 | B-10I | 1 | 12 | | | 285 | 83 | 368 | 530 |
| | 1020 | | | | | | | 65 | 65 | 71 |
| | 1100 | B-10K | 1 | 12 | | | 285 | 221 | 506 | 685 |
| | 1120 | | | | | | | 105 | 105 | 115 |
| | 1300 | B-6 | 115 | .209 | L.F. | 5.70 | 4.47 | 1.81 | 11.98 | 15.30 |
| | 1400 | | 100 | .240 | | 8.25 | 5.15 | 2.08 | 15.48 | 19.50 |

022 | Earthwork

| 022 200 Excav./Backfill/Compact. | | CREW | DAILY OUTPUT | LABOR HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL INCL O&P |
|------------------------------------|---|-------|--------------|-------------|------|-----------------|-------|--------|-------|----------------|
| | | | | | | MAT. | LABOR | EQUIP. | TOTAL | |
| 226 | 6270 4 passes | B-10C | 2,600 | .005 | C.Y. | | .11 | .37 | .48 | .57 |
| | 7000 Walk behind, vibrating plate 18" wide, 6" lifts, 2 passes | A-1 | 280 | .029 | | | .57 | .22 | .79 | 1.14 |
| | 7020 3 passes | | 185 | .043 | | | .86 | .33 | 1.19 | 1.73 |
| | 7040 4 passes | | 140 | .057 | | | 1.13 | .43 | 1.56 | 2.28 |
| | 7200 12" lifts, 2 passes | | 560 | .014 | | | .28 | .11 | .39 | .57 |
| | 7220 3 passes | | 375 | .021 | | | .42 | .16 | .58 | .85 |
| | 7240 4 passes | | 280 | .029 | | | .57 | .22 | .79 | 1.14 |
| | 7500 Vibrating roller 24" wide, 6" lifts, 2 passes | B-10A | 420 | .029 | | | .68 | .20 | .88 | 1.27 |
| | 7520 3 passes | | 280 | .043 | | | 1.02 | .31 | 1.33 | 1.92 |
| | 7540 4 passes | | 210 | .057 | | | 1.36 | .41 | 1.77 | 2.56 |
| | 7600 12" lifts, 2 passes | | 840 | .014 | | | .34 | .10 | .44 | .64 |
| | 7620 3 passes | | 560 | .021 | | | .51 | .15 | .66 | .96 |
| | 7640 4 passes | | 420 | .029 | | | .68 | .20 | .88 | 1.27 |
| | 8000 Rammer tamper, 6" to 11", 4" lifts, 2 passes | A-1 | 130 | .062 | | | 1.22 | .46 | 1.68 | 2.45 |
| | 8050 3 passes | | 97 | .082 | | | 1.63 | .62 | 2.25 | 3.29 |
| | 8100 4 passes | | 65 | .123 | | | 2.44 | .93 | 3.37 | 4.91 |
| | 8200 8" lifts, 2 passes | | 260 | .031 | | | .61 | .23 | .84 | 1.22 |
| | 8250 3 passes | | 195 | .041 | | | .81 | .31 | 1.12 | 1.64 |
| | 8300 4 passes | | 130 | .062 | | | 1.22 | .46 | 1.68 | 2.45 |
| | 8400 13" to 18", 4" lifts, 2 passes | | 390 | .021 | | | .41 | .15 | .56 | .82 |
| | 8450 3 passes | | 290 | .028 | | | .55 | .21 | .76 | 1.10 |
| | 8500 4 passes | | 195 | .041 | | | .81 | .31 | 1.12 | 1.64 |
| | 8600 8" lifts, 2 passes | | 780 | .010 | | | .20 | .08 | .28 | .40 |
| | 8650 3 passes | | 585 | .014 | | | .27 | .10 | .37 | .54 |
| | 8700 4 passes | | 390 | .021 | | | .41 | .15 | .56 | .82 |
| 230 | 0010 DRILLING ONLY 2" hole for rock bolts, average | B-47 | 395 | .061 | LF. | | 1.34 | 1.43 | 2.77 | 3.69 |
| | 0800 2-1/2" hole for pre-splitting, average | | 540 | .044 | | | .98 | 1.05 | 2.03 | 2.70 |
| | 1600 Quarry operations, 2-1/2" to 3-1/2" diameter | | 715 | .034 | | | .74 | .79 | 1.53 | 2.04 |
| | 1610 6" diameter drill holes | B-47A | 1,350 | .018 | | | .42 | .33 | .75 | 1.01 |
| 234 | 0010 DRILLING AND BLASTING Only, rock, open face, under 1500 C.Y. | B-47 | 225 | .107 | C.Y. | 1.50 | 2.36 | 2.52 | 6.38 | 8.15 |
| | 0100 Over 1500 C.Y. | | 300 | .080 | | 1.50 | 1.77 | 1.89 | 5.16 | 6.50 |
| | 0300 Bulk drilling and blasting, can vary greatly, average | | | | | | | | | 3.95 |
| | 0500 Pits, average | | | | | | | | | 20 |
| | 1300 Deep hole method, up to 1500 C.Y. | B-47 | 50 | .480 | | 1.50 | 10.60 | 11.30 | 23.40 | 31 |
| | 1400 Over 1500 C.Y. | | 66 | .364 | | 1.50 | 8.05 | 8.55 | 18.10 | 24 |
| | 1900 Restricted areas, up to 1500 C.Y. | | 13 | 1.846 | | 1.50 | 41 | 43.50 | 86 | 114 |
| | 2000 Over 1500 C.Y. | | 20 | 1.200 | | 1.50 | 26.50 | 28.50 | 56.50 | 74 |
| | 2200 Trenches, up to 1500 C.Y. | | 22 | 1.091 | | 4.50 | 24 | 25.50 | 54 | 71.50 |
| | 2300 Over 1500 C.Y. | | 26 | .923 | | 4.29 | 20.50 | 22 | 46.79 | 60.50 |
| | 2500 Pier holes, up to 1500 C.Y. | | 22 | 1.091 | | 1.50 | 24 | 25.50 | 51 | 68 |
| | 2600 Over 1500 C.Y. | | 31 | .774 | | 1.50 | 17.10 | 18.25 | 36.85 | 48.50 |
| | 2800 Boulders under 1/2 C.Y., loaded on truck, no hauling | B-100 | 80 | .150 | | | 3.56 | 6.15 | 9.71 | 12.30 |
| | 2900 Drilled, blasted and loaded on truck, no hauling | B-47 | 30 | .800 | | 1.50 | 17.70 | 18.85 | 38.05 | 50.50 |
| | 3100 Jackhammer operators with foreman compressor, air tools | B-9 | 1 | 40 | Day | | 810 | 152 | 962 | 1,475 |
| | 3300 Track drill, compressor, operator and foreman | B-47 | 1 | 24 | | | 530 | 565 | 1,095 | 1,450 |
| | 3500 Blasting caps | | | | Ea. | 2.50 | | | 2.50 | 2.75 |
| | 3700 Explosives | | | | Lb. | 1.50 | | | 1.50 | 1.65 |
| | 3900 Blasting mats, rent, for first day | | | | Ea. | 80 | | | 80 | 88 |
| | 4000 Per added day | | | | | 25 | | | 25 | 27.50 |
| | 4200 Preblast survey for 6 room house, individual lot, minimum | A-6 | 2.40 | 6.667 | | | 155 | | 155 | 239 |
| | 4300 Maximum | | 1.35 | 11.852 | | | 276 | | 276 | 425 |
| | 4500 City block within zone of influence, minimum | A-8 | 25,200 | .001 | S.F. | | .03 | | .03 | .04 |
| | 4600 Maximum | | 15,100 | .002 | | | .05 | | .05 | .07 |
| | 5000 Excavate and load boulders, less than 0.5 C.Y. | B-10T | 80 | .150 | C.Y. | | 3.56 | 5.35 | 8.91 | 11.40 |
| | 5020 0.5 C.Y. to 1 C.Y. | B-10U | 100 | .120 | | | 2.85 | 8.95 | 11.80 | 14.25 |

022 | Earthwork

2 SITE WORK

| 022 200 Excav./Backfill/Compact. | | | | CREW | DAILY OUTPUT | LABOR HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL INCL O&P |
|------------------------------------|---|--|----------|-------|--------------|-------------|------|-----------------|-------|--------|-------|----------------|
| | | | | | | | | MAT. | LABOR | EQUIP. | TOTAL | |
| 250 | 2050 | 1-1/2 C.Y. bucket | R022-240 | B-12B | 144 | .111 | C.Y. | | 2.70 | 4.93 | 7.63 | 9.60 |
| | 2060 | 2 C.Y. bucket | | B-12C | 200 | .080 | | 1.95 | 4.88 | 6.83 | 8.35 | |
| | 2070 | Sand and gravel, 3/4 C.Y. bucket | B-12F | 100 | .160 | | 3.89 | 4.51 | 8.40 | 10.95 | | |
| | 2080 | 1 C.Y. bucket | B-12A | 120 | .133 | | 3.24 | 4.59 | 7.83 | 10.05 | | |
| | 2090 | 1-1/2 C.Y. bucket | B-12B | 160 | .100 | | 2.43 | 4.44 | 6.87 | 8.65 | | |
| | 3000 | 2 C.Y. bucket | B-12C | 220 | .073 | | 1.77 | 4.44 | 6.21 | 7.60 | | |
| | 3010 | Clay, till, or blasted rock, 3/4 C.Y. bucket | B-12F | 80 | .200 | | 4.87 | 5.65 | 10.52 | 13.70 | | |
| | 3020 | 1 C.Y. bucket | B-12A | 95 | .168 | | 4.10 | 5.80 | 9.90 | 12.70 | | |
| | 3030 | 1-1/2 C.Y. bucket | B-12B | 130 | .123 | | 2.99 | 5.45 | 8.44 | 10.60 | | |
| | 3040 | 2 C.Y. bucket | B-12C | 175 | .091 | ↓ | 2.22 | 5.60 | 7.82 | 9.55 | | |
| | 9010 | For mobilization or demobilization, see div. 022-274 | | | | | | | | | | |
| | 9020 | For dewatering, see div. 021-404 | | | | | | | | | | |
| | 9022 | For larger structures, see Bulk Excavation, div. 022-238 | | | | | | | | | | |
| | 9024 | For loading onto trucks, add | | | | | | | 15% | | | |
| 9026 | For hauling, see div. 022-266 | | | | | | | | | | | |
| 9030 | For sheeting or soldier beams & lagging, see div. 021-614 & 624 | | | | | | | | | | | |
| 9040 | For trench excavation of strip footings, see div. 022-254 | ↓ | | | | | | | | | | |
| 254 | 0010 | EXCAVATING, TRENCH or continuous footing, common earth | R022-240 | | | | | | | | | |
| | 0020 | No sheeting or dewatering included | | | | | | | | | | |
| | 0050 | 1' to 4' deep, 3/8 C.Y. tractor loader/backhoe | B-11C | 150 | .107 | C.Y. | | 2.43 | 1.39 | 3.82 | 5.30 | |
| | 0060 | 1/2 C.Y. tractor loader/backhoe | B-11M | 200 | .080 | | | 1.82 | 1.43 | 3.25 | 4.41 | |
| | 0062 | 3/4 C.Y. hydraulic backhoe | B-12F | 270 | .059 | | | 1.44 | 1.67 | 3.11 | 4.06 | |
| | 0090 | 4' to 6' deep, 1/2 C.Y. tractor loader/backhoe | B-11M | 200 | .080 | | | 1.82 | 1.43 | 3.25 | 4.41 | |
| | 0100 | * 5/8 C.Y. hydraulic backhoe | B-12Q | 250 | .064 | | | 1.56 | 1.58 | 3.14 | 4.12 | |
| | 0110 | 3/4 C.Y. hydraulic backhoe | B-12F | 300 | .053 | | | 1.30 | 1.50 | 2.80 | 3.64 | |
| | 0120 | 1 C.Y. hydraulic backhoe | B-12A | 400 | .040 | | | .97 | 1.38 | 2.35 | 3.02 | |
| | 0130 | 1-1/2 C.Y. hydraulic backhoe | B-12B | 540 | .030 | | | .72 | 1.32 | 2.04 | 2.56 | |
| | 0300 | 1/2 C.Y. hydraulic excavator, truck mounted | B-12J | 200 | .080 | | | 1.95 | 3.15 | 5.10 | 6.45 | |
| | 0500 | 6' to 10' deep, 3/4 C.Y. hydraulic backhoe | B-12F | 225 | .071 | | | 1.73 | 2 | 3.73 | 4.86 | |
| | 0510 | 1 C.Y. hydraulic backhoe | B-12A | 400 | .040 | | | .97 | 1.38 | 2.35 | 3.02 | |
| | 0600 | 1 C.Y. hydraulic excavator, truck mounted | B-12K | 400 | .040 | | | .97 | 2.17 | 3.14 | 3.88 | |
| | 0610 | 1-1/2 C.Y. hydraulic backhoe | B-12B | 600 | .027 | | | .65 | 1.18 | 1.83 | 2.30 | |
| | 0620 | 2-1/2 C.Y. hydraulic backhoe | B-12S | 1,000 | .016 | | | .39 | 1.74 | 2.13 | 2.51 | |
| | 0900 | 10' to 14' deep, 3/4 C.Y. hydraulic backhoe | B-12F | 200 | .080 | | | 1.95 | 2.25 | 4.20 | 5.45 | |
| | 0910 | 1 C.Y. hydraulic backhoe | B-12A | 360 | .044 | | | 1.08 | 1.53 | 2.61 | 3.34 | |
| | 1000 | 1-1/2 C.Y. hydraulic backhoe | B-12B | 540 | .030 | | | .72 | 1.32 | 2.04 | 2.56 | |
| | 1020 | 2-1/2 C.Y. hydraulic backhoe | B-12S | 1,000 | .016 | | | .39 | 1.74 | 2.13 | 2.51 | |
| | 1030 | 3 C.Y. hydraulic backhoe | B-12D | 1,400 | .011 | | | .28 | 1.56 | 1.84 | 2.15 | |
| | 1300 | 14' to 20' deep, 1 C.Y. hydraulic backhoe | B-12A | 320 | .050 | | | 1.22 | 1.72 | 2.94 | 3.77 | |
| | 1310 | 1-1/2 C.Y. hydraulic backhoe | B-12B | 480 | .033 | | | .81 | 1.48 | 2.29 | 2.88 | |
| | 1320 | 2-1/2 C.Y. hydraulic backhoe | B-12S | 850 | .019 | | | .46 | 2.04 | 2.50 | 2.95 | |
| | 1330 | 3 C.Y. hydraulic backhoe | B-12D | 1,000 | .016 | | | .39 | 2.18 | 2.57 | 3 | |
| | 1400 | By hand with pick and shovel to 6' deep, light soil | 1 Clab | 8 | 1 | | | 19.80 | | 19.80 | 31.50 | |
| | 1500 | Heavy soil | | 4 | 2 | | | 39.50 | | 39.50 | 63 | |
| | 1700 | For tamping backfilled trenches, air tamp, add | A-1 | 100 | .080 | | | 1.58 | .60 | 2.18 | 3.19 | |
| | 1900 | Vibrating plate, add | | 90 | .089 | ↓ | | 1.76 | .67 | 2.43 | 3.55 | |
| | 2100 | Trim sides and bottom for concrete pours, common earth | | 600 | .013 | S.F. | | .26 | .10 | .36 | .53 | |
| | 2300 | Hardpan | ↓ | 180 | .044 | | | .88 | .33 | 1.21 | 1.77 | |
| | 2400 | Pier and spread footing excavation, add to above | | | | C.Y. | | | | 30% | 30% | |
| | 3000 | Backfill trench, F.E. loader, wheel mtd., 1 C.Y. bucket | | | | | | | | | | |
| | 3020 | * Minimal haul | B-10R | 400 | .030 | C.Y. | | .71 | .58 | 1.29 | 1.75 | |
| 3040 | 100' haul | | 200 | .060 | | | 1.42 | 1.17 | 2.59 | 3.49 | | |
| 3060 | 200' haul | | 100 | .120 | | | 2.85 | 2.33 | 5.18 | 7 | | |
| 3080 | 2-1/4 C.Y. bucket, minimum haul | B-10T | 600 | .020 | | | .47 | .71 | 1.18 | 1.5 | | |
| 3090 | 100' haul | | 300 | .040 | ↓ | | .95 | 1.42 | 2.37 | 3.03 | | |

025 | Paving & Surfacing

025 800 | Pavement Marking

| 025 800 Pavement Marking | | | CREW | DAILY OUTPUT | LABOR- HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL INCL O&P |
|----------------------------|--------------------------|---|--------|-----------------|-----------------|------|-----------------|-------|--------|-------|-------------------|
| | | | | | | | MAT. | LABOR | EQUIP. | TOTAL | |
| 810 | 0110 | 13"x7-1/2"x2-1/2" high, non-plowable install | 2 Clab | 96 | .167 | Ea. | 17 | 3.30 | | 20.30 | 24 |
| | 0200 | 8" x 8"x 3-1/4" high, non-plowable, install | | 96 | .167 | | 18 | 3.30 | | 21.30 | 25 |
| | 0230 | 4" x 4" x 3/4" high, non-plowable, install | ↓ | 120 | .133 | | 1.62 | 2.64 | | 4.26 | 6 |
| | 0240 | 9-1/4" x 5-7/8" x 1/4" high, plowable, concrete pav't | A-2A | 70 | .343 | | 13.85 | 6.85 | 3.92 | 24.62 | 30.50 |
| | 0250 | 9-1/4" x 5-7/8" x 1/4" high, plowable, asphalt pav't | " | 120 | .200 | | 1.75 | 4 | 2.28 | 8.03 | 10.75 |
| | 0300 | Barrier and curb delineators, reflectorized, 2" x 4" | 2 Clab | 150 | .107 | | 1.15 | 2.11 | | 3.26 | 4.64 |
| | 0310 | 3" x 5" | " | 150 | .107 | ↓ | 2.45 | 2.11 | | 4.56 | 6.05 |
| | 0500 | Rumble strip, polycarbonate | | | | | | | | | |
| 0510 | 24" x 3-1/2" x 1/2" high | 2 Clab | 50 | .320 | Ea. | 4.55 | 6.35 | | 10.90 | 15.10 | |

026 | Piped Utilities

026 010 | Piped Utilities

| 026 010 Piped Utilities | | | CREW | DAILY OUTPUT | LABOR- HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL |
|---------------------------|------|---|--------|-----------------|-----------------|------|-----------------|-------|--------|-------|----------|
| | | | | | | | MAT. | LABOR | EQUIP. | TOTAL | INCL O&P |
| 012 | 0010 | BEDDING For pipe and conduit, not incl. compaction | | | | | | | | | |
| | 0050 | Crushed or screened bank run gravel | B-6 | 150 | .160 | C.Y. | 12.55 | 3.43 | 1.39 | 17.37 | 20.50 |
| | 0100 | Crushed stone 3/4" to 1/2" | ↓ | 150 | .160 | | 13 | 3.43 | 1.39 | 17.82 | 21 |
| | 0200 | Sand, dead or bank, | ↓ | 150 | .160 | | 3.75 | 3.43 | 1.39 | 8.57 | 11.05 |
| | 0500 | Compacting bedding in trench | A-1 | 90 | .089 | ↓ | | 1.76 | .67 | 2.43 | 3.55 |
| 014 | 0010 | EXCAVATION AND BACKFILL See division 022-204 & 254 | | | | | | | | | |
| | 0100 | Hand excavate and trim for pipe bells after trench excavation | | | | | | | | | |
| | 0200 | 8" pipe | 1 Clab | 155 | .052 | L.F. | | 1.02 | | 1.02 | 1.63 |
| | 0300 | 18" pipe | " | 130 | .062 | " | | 1.22 | | 1.22 | 1.94 |

026 050 | Manholes & Cleanouts

| | | | | | | | | | | | |
|-----|------|---|------|------|--------|-----|-------|-------|-------|--------|-------|
| 054 | 0010 | UTILITY VAULTS Precast concrete, 6" thick | | | | | | | | | |
| | 0040 | 4' x 6' x 6' high, I.D. | B-13 | 2 | 28 | Ea. | 1,400 | 600 | 256 | 2,256 | 2,750 |
| | 0050 | 5' x 10' x 6' high, I.D. | | 2 | 28 | | 1,725 | 600 | 256 | 2,581 | 3,125 |
| | 0100 | 6' x 10' x 6' high, I.D. | | 2 | 28 | | 1,775 | 600 | 256 | 2,631 | 3,175 |
| | 0150 | 5' x 12' x 6' high, I.D. | | 2 | 28 | | 1,900 | 600 | 256 | 2,756 | 3,300 |
| | 0200 | 6' x 12' x 6' high, I.D. | | 1.80 | 31.111 | | 2,125 | 665 | 285 | 3,075 | 3,700 |
| | 0250 | 6' x 13' x 6' high, I.D. | | 1.50 | 37.333 | | 2,775 | 800 | 340 | 3,915 | 4,675 |
| | 0300 | 8' x 14' x 7' high, I.D. | ↓ | 1 | 56 | ↓ | 3,000 | 1,200 | 515 | 4,715 | 5,775 |
| | 0350 | Hand hole, precast concrete, 1-1/2" thick | | | | | | | | | |
| | 0400 | 1'-0" x 2'-0" x 1'-9", I.D., light duty | B-1 | 4 | 6 | Ea. | 260 | 123 | | 383 | 480 |
| | 0450 | 4'-6" x 3'-2" x 2'-0", O.D., heavy duty | B-6 | 3 | 8 | | 550 | 171 | 69.50 | 790.50 | 950 |
| | 0460 | Meter pit, 4' x 4', 4' deep | | 2 | 12 | | 880 | 257 | 104 | 1,241 | 1,500 |
| | 0470 | 6' deep | | 1.60 | 15 | | 1,250 | 320 | 130 | 1,700 | 2,025 |
| | 0480 | 8' deep | | 1.40 | 17.143 | | 1,650 | 365 | 148 | 2,163 | 2,575 |
| | 0490 | 10' deep | | 1.20 | 20 | | 2,100 | 430 | 173 | 2,703 | 3,175 |
| | 0500 | 15' deep | | 1 | 24 | | 3,075 | 515 | 208 | 3,798 | 4,425 |
| | 0510 | 6' x 6', 4' deep | | 1.40 | 17.143 | | 1,000 | 365 | 148 | 1,513 | 1,850 |
| | 0520 | 6' deep | | 1.20 | 20 | | 1,500 | 430 | 173 | 2,103 | 2,525 |
| | 0530 | 8' deep | | 1 | 24 | | 2,000 | 515 | 208 | 2,723 | 3,250 |
| | 0540 | 10' deep | | .80 | 30 | | 2,500 | 645 | 260 | 3,405 | 4,025 |
| | 0550 | 15' deep | ↓ | .60 | 40 | ↓ | 3,800 | 855 | 345 | 5,000 | 5,900 |

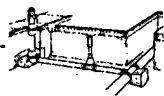
026 | Piped Utilities

026 400 | Valves & Cocks

| | | CREW | DAILY OUTPUT | LABOR- HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL INCL O&P |
|------|--|--------|-----------------|-----------------|------|-----------------|-------|--------|----------|-------------------|
| | | | | | | MAT. | LABOR | EQUIP. | TOTAL | |
| 3820 | 12" diameter | B-21 | 3 | 9.333 | Ea. | 1,625 | 216 | 36 | 1,877 | 2,175 |
| 3822 | 14" diameter | | 2 | 14 | | 3,025 | 325 | 54 | 3,404 | 3,900 |
| 3824 | 16" diameter | | 1 | 28 | | 4,425 | 645 | 108 | 5,178 | 6,000 |
| 3826 | 18" diameter | | .80 | 35 | | 6,575 | 810 | 135 | 7,520 | 8,675 |
| 3828 | 20" diameter | | .80 | 35 | | 8,700 | 810 | 135 | 9,645 | 11,000 |
| 3830 | 24" diameter | | .50 | 56 | | 12,000 | 1,300 | 217 | 13,517 | 15,500 |
| 3831 | 30" diameter | | .35 | 80 | | 25,500 | 1,850 | 310 | 27,660 | 31,300 |
| 3832 | 36" diameter | | .30 | 93.333 | | 32,400 | 2,150 | 360 | 34,910 | 39,500 |
| 3840 | With boxes | B-20 | 5 | 4.800 | Ea. | 270 | 108 | | 378 | 470 |
| 3842 | * 4" diameter | | 4 | 6 | | 450 | 135 | | 585 | 710 |
| 3844 | * 6" diameter | B-21 | 3.50 | 8 | | 755 | 185 | 31 | 971 | 1,150 |
| 3846 | * 8" diameter | | 3 | 9.333 | | 1,220 | 216 | 36 | 1,472 | 1,725 |
| 3848 | 10" diameter | | 3 | 9.333 | | 1,695 | 216 | 36 | 1,974 | 2,250 |
| 3850 | * 12" diameter | | 2 | 14 | | 3,095 | 325 | 54 | 3,747 | 3,975 |
| 3852 | * 14" diameter | | 1 | 28 | | 4,495 | 645 | 108 | 5,248 | 6,075 |
| 3854 | * 16" diameter | | 0.8 | 35 | | 6,645 | 810 | 135 | 7,590 | 8,750 |
| 3856 | 18" diameter | | 0.8 | 35 | | 8,770 | 810 | 135 | 9,715 | 11,100 |
| 3858 | 20" diameter | | .50 | 56 | | 12,070 | 1,300 | 217 | 13,587 | 15,600 |
| 3860 | * 24" diameter | | | | | 425 | | | 425 | 470 |
| 3880 | Sleeve, for tapping mains, 8" x 4", add | | | | | | | | | |
| 3900 | Globe valves, flanged, iron body, class 125 | B-20 | 10 | 2.400 | Ea. | 335 | 54 | | 389 | 455 |
| 3910 | 4" diameter | | 10 | 2.400 | | 555 | 54 | | 609 | 695 |
| 3912 | 5" diameter | | 9 | 2.667 | | 585 | 60 | | 645 | 735 |
| 3914 | 6" diameter | B-21 | 6 | 4.667 | | 1,075 | 108 | 18.05 | 1,201.05 | 1,400 |
| 3916 | 8" diameter | | 5 | 5.600 | | 2,000 | 129 | 21.50 | 2,150.50 | 2,425 |
| 3918 | 10" diameter | | 4 | 7 | | 2,800 | 162 | 27 | 2,989 | 3,350 |
| 3920 | 12" diameter | | 3 | 9.333 | | 3,000 | 216 | 36 | 3,252 | 3,675 |
| 3922 | 14" diameter | | 2 | 14 | | 4,400 | 325 | 54 | 4,779 | 5,425 |
| 3924 | 16" diameter | | .80 | 35 | | 4,850 | 810 | 135 | 5,795 | 6,750 |
| 3926 | 18" diameter | | .60 | 46.667 | | 7,250 | 1,075 | 181 | 8,506 | 9,900 |
| 3928 | 20" diameter | | .50 | 56 | | 8,600 | 1,300 | 217 | 10,117 | 11,700 |
| 3930 | 24" diameter | | | | | | | | | |
| 5010 | Piping, site utility, fittings, corporations, brass, 3/4" diameter | 1 Plum | 19 | .421 | | 10.50 | 12.65 | | 23.15 | 31 |
| 5040 | 1" diameter | | 16 | .500 | | 17.10 | 15 | | 32.10 | 42 |
| 5060 | 1-1/2" diameter | | 13 | .615 | | 47.50 | 18.50 | | 66 | 80.50 |
| 5080 | 2" diameter | | 11 | .727 | | 81 | 22 | | 103 | 123 |
| 5200 | Curb stops, brass, 3/4" diameter | | 19 | .421 | | 15 | 12.65 | | 27.65 | 36 |
| 5220 | 1" diameter | | 16 | .500 | | 23.50 | 15 | | 38.50 | 48.50 |
| 5240 | 1-1/2" diameter | | 13 | .615 | | 58.50 | 18.50 | | 77 | 93 |
| 5260 | 2" diameter | | 11 | .727 | | 94 | 22 | | 116 | 137 |
| 5400 | Curb box, cast iron, 3/4" diameter | | 12 | .667 | | 28 | 20 | | 48 | 61.50 |
| 5420 | 2" diameter | | 8 | 1 | | 75 | 30 | | 105 | 129 |
| 5500 | Saddles, cast iron, 3/4", add | | | | | 30 | | | 30 | 33 |
| 5550 | 2", add | | | | | 35 | | | 35 | 38.50 |

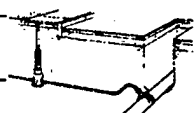
026 450 | Hydrants

| | | | | | | | | | | |
|------|---|------|----|-------|-----|-------|-------|-------|----------|-------|
| 0010 | PIPING, WATER DISTRIBUTION Mech. joints unless noted | | | | | | | | | |
| 1000 | Fire hydrants, two way; excavation and backfill not incl. | | | | | | | | | |
| 1100 | 4-1/2" valve size, depth 2'-0" | B-21 | 10 | 2.800 | Ea. | 735 | 64.50 | 10.85 | 810.35 | 925 |
| 1120 | 2'-6" | | 10 | 2.800 | | 760 | 64.50 | 10.85 | 835.35 | 950 |
| 1140 | 3'-0" | | 10 | 2.800 | | 785 | 64.50 | 10.85 | 860.35 | 980 |
| 1160 | 3'-6" | | 9 | 3.111 | | 810 | 72 | 12.05 | 894.05 | 1,025 |
| 1200 | 4'-6" | | 9 | 3.111 | | 835 | 72 | 12.05 | 919.05 | 1,050 |
| 1220 | 5'-0" | | 8 | 3.500 | | 860 | 81 | 13.55 | 954.55 | 1,100 |
| 1240 | 5'-6" | | 8 | 3.500 | | 915 | 81 | 13.55 | 1,009.55 | 1,150 |
| 1260 | * 6'-0" | | 7 | 4 | | 1,000 | 92.50 | 15.50 | 1,108 | 1,275 |



026 | Piped Utilities

2 SITE WORK

| 026 650 Water Systems | | | CREW | DAILY OUTPUT | LABOR- HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL INCL O&P | | |
|-------------------------|-------------------------|--|---|-----------------|-----------------|--------|-----------------|-------|--------|----------|-------------------|-------|-----|
| | | | | | | | MAT. | LABOR | EQUIP. | TOTAL | | | |
| 662 | 7250 | For copper fittings, see Div. 151-430 | | | | | | | | | | | |
| 666 | 0010 | PIPING, WATER DISTRIBUTION, DUCTILE IRON cement lined | | | | | | | | | | | |
| | 0020 | Not including excavation or backfill | | | | | | | | | | | |
| | 2000 | Pipe, class 50 water piping, 18' lengths | | | | | | | | | | | |
| | 2020 | Mechanical joint, 4" diameter | B-20 | 144 | .167 | LF. | 7.40 | 3.75 | | | 11.15 | 14.15 | |
| | 2040 | 6" diameter | | 126 | .190 | | 8.45 | 4.29 | | | 12.74 | 16.15 | |
| | 2060 | 8" diameter | B-21 | 108 | .259 | | 11.15 | 6 | 1 | | 18.15 | 23 | |
| | 2080 | 10" diameter | | 90 | .311 | | 14.20 | 7.20 | 1.20 | | 22.60 | 28.50 | |
| | 2100 | 12" diameter | | 72 | .389 | | 18.50 | 9 | 1.51 | | 29.01 | 36.50 | |
| | 2120 | 14" diameter | | 54 | .519 | | 23 | 12 | 2.01 | | 37.01 | 47 | |
| | 2140 | 16" diameter | | 46 | .609 | | 25.50 | 14.05 | 2.36 | | 41.91 | 53 | |
| | 2160 | 18" diameter | B-22 | 38 | .789 | | 28.50 | 18.45 | 4.27 | | 51.22 | 64.50 | |
| | 2170 | 20" diameter | | 37 | .811 | | 32.50 | 18.95 | 4.39 | | 55.84 | 70.50 | |
| | 2180 | 24" diameter | | 36 | .833 | | 45.50 | 19.45 | 4.51 | | 69.46 | 86 | |
| | 3000 | Tyton, Push-on joint, 4" diameter | B-20 | 158 | .152 | | 6.15 | 3.42 | | | 9.57 | 12.25 | |
| | 3020 | 6" diameter | | 138 | .174 | | 6.85 | 3.92 | | | 10.77 | 13.80 | |
| | 3040 | 8" diameter | B-21 | 118 | .237 | | 8.70 | 5.50 | .92 | | 15.12 | 19.25 | |
| | 3060 | 10" diameter | | 100 | .280 | | 11.50 | 6.45 | 1.08 | | 19.03 | 24 | |
| | 3080 | 12" diameter | | 80 | .350 | | 14.65 | 8.10 | 1.35 | | 24.10 | 30.50 | |
| | 3100 | 14" diameter | | 60 | .467 | | 17.95 | 10.80 | 1.81 | | 30.56 | 39 | |
| | 3120 | 16" diameter | | 54 | .519 | | 21 | 12 | 2.01 | | 35.01 | 45 | |
| | 3140 | 18" diameter | B-22 | 44 | .682 | | 24 | 15.95 | 3.69 | | 43.64 | 55.50 | |
| | 3160 | 20" diameter | | 42 | .714 | | 26.50 | 16.70 | 3.86 | | 47.06 | 60 | |
| | 3180 | 24" diameter | | 40 | .750 | | 32.50 | 17.50 | 4.06 | | 54.06 | 67.50 | |
| | 4000 | Drill and tap pressurized main (labor only) | | | | | | | | | | | |
| | 4100 | 6" main, 1" to 2" service | Q-1 | 3 | 5.333 | Ea. | | 144 | | | 144 | 221 | |
| | 4150 | 8" main, 1" to 2" service | | 2.75 | 5.818 | | | 157 | | | 157 | 241 | |
| | 4500 | Tap and insert gate valve |  | | | | | | | | | | |
| | 4600 | 8" main, 4" branch | | B-21 | 3.20 | 8.750 | Ea. | | 202 | 34 | | 236 | 355 |
| | 4650 | 6" branch | | | 2.70 | 10.370 | | | 240 | 40 | | 280 | 425 |
| | 4651 | Piping, drill, tap & insert gate valve, 8" main, 6" branch | | | 2.70 | 10.370 | | | 240 | 40 | | 280 | 425 |
| | 4700 | 10" main, 4" branch | | 2.70 | 10.370 | | | 240 | 40 | | 280 | 425 | |
| | 4750 | 6" branch | | 2.35 | 11.915 | | | 275 | 46 | | 321 | 485 | |
| | 4800 | 12" main, 6" branch | | 2.35 | 11.915 | | | 275 | 46 | | 321 | 485 | |
| | 4850 | 8" branch | | 2.35 | 11.915 | | | 275 | 46 | | 321 | 485 | |
| | 8000 | Fittings | | | | | | | | | | | |
| | 8006 | Mechanical joint, 90° bend or elbows, 4" diameter | B-20 | 37 | .649 | Ea. | 90 | 14.60 | | | 104.60 | 123 | |
| | 8020 | * 6" diameter | | 25 | .960 | | 121 | 21.50 | | | 142.50 | 168 | |
| | 8040 | * 8" diameter | | 21 | 1.143 | | 197 | 25.50 | | | 222.50 | 258 | |
| | 8060 | * 10" diameter | B-21 | 21 | 1.333 | | 253 | 31 | 5.15 | | 289.15 | 335 | |
| | 8080 | * 12" diameter | | 18 | 1.556 | | 335 | 36 | 6 | | 377 | 430 | |
| 8100 | 14" diameter | | 16 | 1.750 | | 540 | 40.50 | 6.75 | | 587.25 | 665 | | |
| 8120 | * 16" diameter | | 14 | 2 | | 610 | 46 | 7.75 | | 663.75 | 750 | | |
| 8140 | 18" diameter | | 10 | 2.800 | | 940 | 64.50 | 10.85 | | 1,015.35 | 1,150 | | |
| 8160 | 20" diameter | | 8 | 3.500 | | 1,050 | 81 | 13.55 | | 1,144.55 | 1,325 | | |
| 8180 | * 24" diameter | | 6 | 4.667 | | 1,400 | 108 | 18.05 | | 1,526.05 | 1,725 | | |
| 8200 | Wye or tee, 4" diameter | B-20 | 25 | .960 | | 131 | 21.50 | | | 152.50 | 179 | | |
| 8220 | * 6" diameter | | 17 | 1.412 | | 182 | 32 | | | 214 | 251 | | |
| 8240 | * 8" diameter | | 14 | 1.714 | | 258 | 38.50 | | | 296.50 | 345 | | |
| 8260 | 10" diameter | B-21 | 14 | 2 | | 410 | 46 | 7.75 | | 463.75 | 530 | | |
| 8280 | 12" diameter | | 12 | 2.333 | | 535 | 54 | 9.05 | | 598.05 | 685 | | |
| 8300 | * 14" diameter | | 10 | 2.800 | | 655 | 64.50 | 10.85 | | 730.35 | 835 | | |
| 8320 | * 16" diameter | | 8 | 3.500 | | 920 | 81 | 13.55 | | 1,014.55 | 1,150 | | |
| 8340 | 18" diameter | | 6 | 4.667 | | 1,375 | 108 | 18.05 | | 1,501.05 | 1,700 | | |
| 8360 | 20" diameter | | 4 | 7 | | 1,575 | 162 | 27 | | 1,764 | 2,000 | | |

026 | Piped Utilities

026 650 | Water Systems

| 026 650 Water Systems | | CREW | DAILY OUTPUT | LABOR- HOURS | UNIT | 1996 BARE COSTS | | | | TOTAL INCL O&P | |
|-------------------------|--|------|-----------------|-----------------|------|-----------------|-------|--------|----------|-------------------|-----|
| | | | | | | MAT. | LABOR | EQUIP. | TOTAL | | |
| 8380 | * 24" diameter | B-21 | 3 | 9.333 | Ea. | 2,125 | 216 | 36 | 2,377 | 2,700 | 666 |
| 8400 | 45° bends, 6" diameter | B-20 | 24 | 1 | | 111 | 22.50 | | 133.50 | 158 | |
| 8410 | 12" diameter | | 16 | 1.500 | | 293 | 34 | | 327 | 375 | |
| 8420 | 16" diameter | B-21 | 12 | 2.333 | | 505 | 54 | 9.05 | 568.05 | 650 | |
| 8430 | 20" diameter | | 6 | 4.667 | | 855 | 108 | 18.05 | 981.05 | 1,125 | |
| 8440 | 24" diameter | ↓ | 4 | 7 | | 1,225 | 162 | 27 | 1,414 | 1,625 | |
| 8450 | Decreaser, 6" x 4" diameter | B-20 | 12 | 2 | | 92 | 45 | | 137 | 173 | |
| 8460 | 8" x 6" diameter | ↓ | 10 | 2.400 | | 143 | 54 | | 197 | 244 | |
| 8470 | 10" x 6" diameter | ↓ | 9 | 2.667 | | 173 | 60 | | 233 | 287 | |
| 8480 | 12" x 6" diameter | ↓ | 8 | 3 | | 214 | 67.50 | | 281.50 | 345 | |
| 8490 | 6" x 16" diameter | B-21 | 6 | 4.667 | | 355 | 108 | 18.05 | 481.05 | 585 | |
| 8500 | 6" x 20" diameter | | 5 | 5.600 | | 565 | 129 | 21.50 | 715.50 | 855 | |
| 8510 | 6" x 24" diameter | ↓ | 4 | 7 | | 1,075 | 162 | 27 | 1,264 | 1,450 | |
| 8610 | Blind flanges, 150 psi., 4" diameter | Q-1 | 10 | 1.600 | | 39 | 43.50 | | 82.50 | 109 | |
| 8620 | 5" diameter | | 8 | 2 | | 51 | 54 | | 105 | 139 | |
| 8630 | 6" diameter | Q-2 | 10 | 2.400 | | 59 | 67.50 | | 126.50 | 168 | |
| 8640 | 8" diameter | | 8 | 3 | | 97 | 84 | | 181 | 236 | |
| 8650 | 10" diameter | | 7 | 3.429 | | 189 | 96 | | 285 | 355 | |
| 8660 | 12" diameter | | 6 | 4 | | 281 | 112 | | 393 | 480 | |
| 8670 | 14" diameter | | 5 | 4.800 | | 430 | 135 | | 565 | 675 | |
| 8680 | 16" diameter | | 5 | 4.800 | | 480 | 135 | | 615 | 730 | |
| 8690 | 18" diameter | | 4 | 6 | | 580 | 168 | | 748 | 900 | |
| 8700 | 20" diameter | | 3 | 8 | | 725 | 224 | | 949 | 1,150 | |
| 8710 | 24" diameter | ↓ | 2 | 12 | | 1,100 | 335 | | 1,435 | 1,725 | |
| 8720 | 250 psi, 4" diameter | Q-1 | 6 | 2.667 | | 61 | 72 | | 133 | 178 | |
| 8730 | 5" diameter | | 4 | 4 | | 117 | 108 | | 225 | 295 | |
| 8740 | * 6" diameter | Q-2 | 6 | 4 | | 107 | 112 | | 219 | 290 | |
| 8750 | * 8" diameter | ↓ | 4 | 6 | | 163 | 168 | | 331 | 440 | |
| 8760 | * 10" diameter | | 3.40 | 7.059 | | 350 | 198 | | 548 | 690 | |
| 8770 | * 12" diameter | | 2.80 | 8.571 | | 470 | 240 | | 710 | 885 | |
| 8780 | * 14" diameter | | 2.80 | 8.571 | | 745 | 240 | | 985 | 1,200 | |
| 8790 | * 16" diameter | | 2 | 12 | | 865 | 335 | | 1,200 | 1,475 | |
| 8800 | 18" diameter | | 2 | 12 | | 1,175 | 335 | | 1,510 | 1,825 | |
| 8810 | 20" diameter | | 1.50 | 16 | | 1,325 | 450 | | 1,775 | 2,125 | |
| 8820 | * 24" diameter | ↓ | 1 | 24 | | 2,425 | 675 | | 3,100 | 3,700 | |
| 9020 | Slip on weld flanges, 150lbs., 4" diameter | Q-15 | 6 | 2.667 | | 31.50 | 72 | 8.75 | 112.25 | 155 | |
| 9030 | 5" diameter | | 5 | 3.200 | | 44 | 86.50 | 10.55 | 141.05 | 192 | |
| 9040 | 6" diameter | Q-16 | 6 | 4 | | 51 | 112 | 8.75 | 171.75 | 238 | |
| 9050 | 8" diameter | | 5 | 4.800 | | 78.50 | 135 | 10.50 | 224 | 305 | |
| 9060 | 10" diameter | | 4 | 6 | | 143 | 168 | 13.15 | 324.15 | 430 | |
| 9070 | 12" diameter | | 3 | 8 | | 209 | 224 | 17.50 | 450.50 | 595 | |
| 9080 | 14" diameter | | 3 | 8 | | 281 | 224 | 17.50 | 522.50 | 675 | |
| 9090 | 16" diameter | | 2 | 12 | | 340 | 335 | 26.50 | 701.50 | 920 | |
| 9100 | 18" diameter | | 2 | 12 | | 495 | 335 | 26.50 | 856.50 | 1,100 | |
| 9110 | 20" diameter | | 1 | 24 | | 570 | 675 | 52.50 | 1,297.50 | 1,725 | |
| 9120 | 24" diameter | ↓ | 1 | 24 | | 810 | 675 | 52.50 | 1,537.50 | 1,975 | |
| 9130 | 300 lbs., 4" diameter | Q-15 | 6 | 2.667 | | 52 | 72 | 8.75 | 132.75 | 177 | |
| 9140 | 5" diameter | | 4 | 4 | | 84.50 | 108 | 13.15 | 205.65 | 274 | |
| 9150 | 6" diameter | Q-16 | 6 | 4 | | 86.50 | 112 | 8.75 | 207.25 | 277 | |
| 9160 | 8" diameter | ↓ | 4 | 6 | | 143 | 168 | 13.15 | 324.15 | 430 | |
| 9170 | 10" diameter | | 3.40 | 7.059 | | 275 | 198 | 15.45 | 488.45 | 625 | |
| 9180 | 12" diameter | | 2.80 | 8.571 | | 340 | 240 | 18.75 | 598.75 | 765 | |
| 9190 | 14" diameter | | 2.80 | 8.571 | | 630 | 240 | 18.75 | 888.75 | 1,075 | |
| 9200 | 16" diameter | | 2 | 12 | | 690 | 335 | 26.50 | 1,051.50 | 1,300 | |
| 9210 | 18" diameter | | 2 | 12 | | 805 | 335 | 26.50 | 1,166.50 | 1,425 | |
| 9220 | 20" diameter | ↓ | 1.50 | 16 | ↓ | 1,125 | 450 | 35 | 1,610 | 1,950 | |

SITE WORK 2

050 | Metal Materials, Coatings & Fastenings

050 500 | Metal Fastening

| 050 500 Metal Fastening | | | | | | 1996 BARE COSTS | | | | TOTAL | | |
|---------------------------|---|--------|--------------|-------------|-------|-----------------|-------|--------|-------|----------|-------|-----|
| | | CREW | DAILY OUTPUT | LABOR-HOURS | UNIT | MAT. | LABOR | EQUIP. | TOTAL | INCL O&P | | |
| 8250 | 1/2" diameter, 2-3/4" long | 1 Carp | 140 | .057 | Ea. | .98 | 1.44 | | 2.42 | 3.37 | 520 | |
| | 7" long | | 130 | .062 | | 1.69 | 1.55 | | 3.24 | 4.34 | | |
| 8500 | 1" diameter, 6" long | | 100 | .080 | | 8.25 | 2.02 | | 10.27 | 12.30 | | |
| 8600 | 12" long | | 80 | .100 | | 11.50 | 2.52 | | 14.02 | 16.70 | | |
| 8750 | For type 303 stainless steel, add | | | | | 350% | | | | | | |
| 8800 | For type 316 stainless steel, add | | | | | 450% | | | | | | |
| 0010 | LAG SCREWS Steel, 1/4" diameter, 2" long | 1 Carp | 140 | .057 | Ea. | .05 | 1.44 | | 1.49 | 2.36 | 530 | |
| 0100 | 3/8" diameter, 3" long | | 105 | .076 | | .13 | 1.92 | | 2.05 | 3.21 | | |
| 0200 | 1/2" diameter, 3" long | | 95 | .084 | | .24 | 2.12 | | 2.36 | 3.65 | | |
| 0300 | 5/8" diameter, 3" long | | 85 | .094 | | .40 | 2.37 | | 2.77 | 4.23 | | |
| 0010 | MACHINE SCREWS Steel, #8 x 1" long, round head | | | | C | .90 | | | .90 | .99 | 535 | |
| 0110 | #8 x 2" long | | | | | 1.80 | | | 1.80 | 1.98 | | |
| 0200 | #10 x 1" long | | | | | 1.10 | | | 1.10 | 1.21 | | |
| 0300 | #10 x 2" long | | | | | 1.88 | | | 1.88 | 2.07 | | |
| 0010 | MACHINERY ANCHORS Standard, flush mounted, | | | | | | | | | | 540 | |
| 0020 | incl. stud w/fiber plug, nut & washer, anchor & anchor bolt | | | | Ea. | 22 | | | 22 | 24.50 | | |
| 0200 | Material only, 1/2" diameter stud & bolt | | | | | 25.50 | | | 25.50 | 28 | | |
| 0300 | 5/8" diameter | | | | | 27.50 | | | 27.50 | 30 | | |
| 0500 | 3/4" diameter | | | | | 31.50 | | | 31.50 | 35 | | |
| 0600 | 7/8" diameter | | | | | 35 | | | 35 | 38.50 | | |
| 0800 | 1" diameter | | | | | 44 | | | 44 | 48.50 | | |
| 0900 | 1-1/4" diameter | | | | | | | | | | | |
| 0010 | STUDS .22 caliber stud driver, minimum | | | | Ea. | 245 | | | 245 | 270 | 550 | |
| 0100 | Maximum | | | | | 395 | | | 395 | 435 | | |
| 0300 | Powder charges for above, low velocity | | | | C | 18.50 | | | 18.50 | 20.50 | | |
| 0400 | Standard velocity | | | | | 22.50 | | | 22.50 | 25 | | |
| 0010 | TRACK Railroad, bolts | | | | Cwt. | 100 | | | 100 | 110 | 555 | |
| | Joint bars | | | | Pr. | 20 | | | 20 | 22 | | |
| | Spikes | | | | Cwt. | 37.50 | | | 37.50 | 41.50 | | |
| 0300 | Tie plates | | | | Ea. | 12.20 | | | 12.20 | 13.40 | | |
| 0010 | WELD ROD Steel, type E6010/E6011, 1/8" diameter, less than 500# | | | | Lb. | 1 | | | 1 | 1.10 | 570 | |
| 0100 | 500# to 2,000# | | | | | .97 | | | .97 | 1.07 | | |
| 0200 | 2,000# to 5,000# | | | | Lb. | .90 | | | .90 | .99 | | |
| 0400 | Steel, type E6011, 3/16" diameter, less than 500# | | | | | .97 | | | .97 | 1.07 | | |
| 0500 | 500# to 2,000# | | | | | .89 | | | .89 | .98 | | |
| 0600 | 2000# to 5000# | | | | | .84 | | | .84 | .92 | | |
| 0650 | Steel, type E7018, (low hydrogen) 1/8" diam., less than 500# | | | | | .91 | | | .91 | 1 | | |
| 0660 | 500# to 2000# | | | | | .93 | | | .93 | 1.02 | | |
| 0670 | 2,000# to 5,000# | | | | | .82 | | | .82 | .90 | | |
| 0700 | Steel, type E7024, (jet weld) 1/8" diam., less than 500# | | | | | .95 | | | .95 | 1.05 | | |
| 0710 | 500# to 2,000# | | | | | .87 | | | .87 | .96 | | |
| 0720 | 2,000# to 5,000# | | | | | .84 | | | .84 | .92 | | |
| 0800 | Deduct for 5/32" diameter, type E6010 or type E6011 | | | | | .02 | | | .02 | .02 | | |
| 0810 | Semi-automatic coils, 1/16" diameter, 3000# lots | | | | | .83 | | | .83 | .91 | | |
| 1550 | Aluminum, type 4043, 1/8" diameter | | | | | 4.05 | | | 4.05 | 4.46 | | |
| 1600 | 5/32" diameter, 50-100# | | | | | 3.95 | | | 3.95 | 4.35 | | |
| 1810 | 3/16" diameter, 100-500# | | | | | 3.85 | | | 3.85 | 4.23 | | |
| 1900 | Cast iron, 1/8" diameter | | | | | 2.40 | | | 2.40 | 2.64 | | |
| 2000 | Stainless steel, type 308-15, 1/8" diam., less than 499# | | | | | 5.10 | | | 5.10 | 5.60 | | |
| 2100 | 500# to 999# | | | | | 4.80 | | | 4.80 | 5.30 | | |
| 2220 | Over 1000# | | | | | 3.90 | | | 3.90 | 4.29 | | |
| 0010 | WELDING Field. Cost per welder, no operating engineer | RO50 | E-14 | 8 | 1 | Hr. | 3 | 30 | 9.90 | 42.90 | 70 | 575 |
| | With 1/2 operating engineer | -520 | E-13 | 8 | 1.500 | | 3 | 42 | 9.90 | 54.90 | 89 | |
| 0300 | With 1 operating engineer | | E-12 | 8 | 2 | | 3 | 54.50 | 9.90 | 67.40 | 108 | |
| 0500 | With no operating engineer, minimum | | E-14 | 13.30 | .602 | Ton | 2 | 17.95 | 5.95 | 25.90 | 42.50 | |

METALS 5

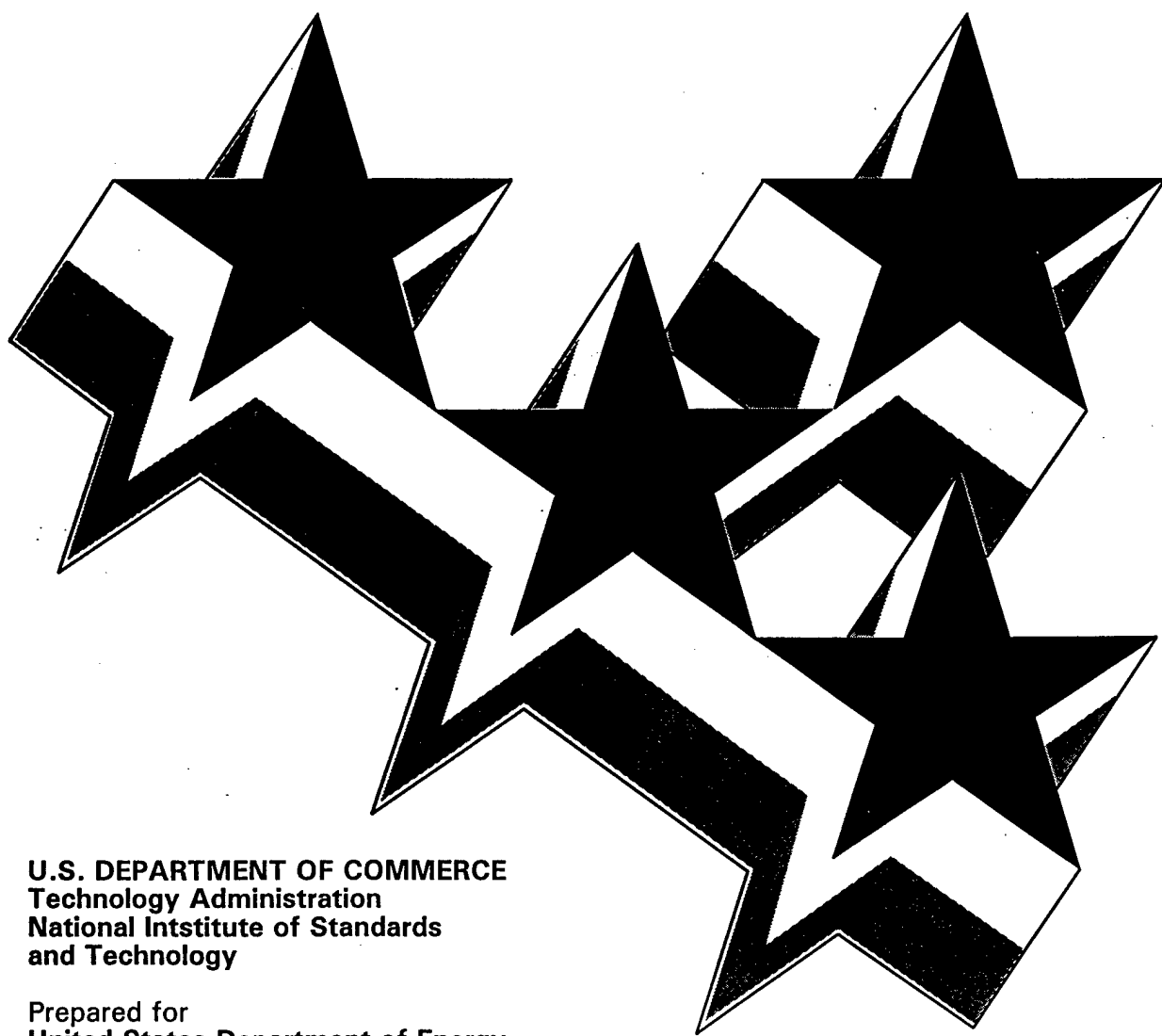
LCCA Economic Factors

NISTIR 85-3273-10
(Rev. 10/95)

Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis 1996

Annual Supplement to
NIST Handbook 135 and
NBS Special Publication 709

Stephen R. Petersen



U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards
and Technology

Prepared for
United States Department of Energy
Federal Energy Management Program

October 1995

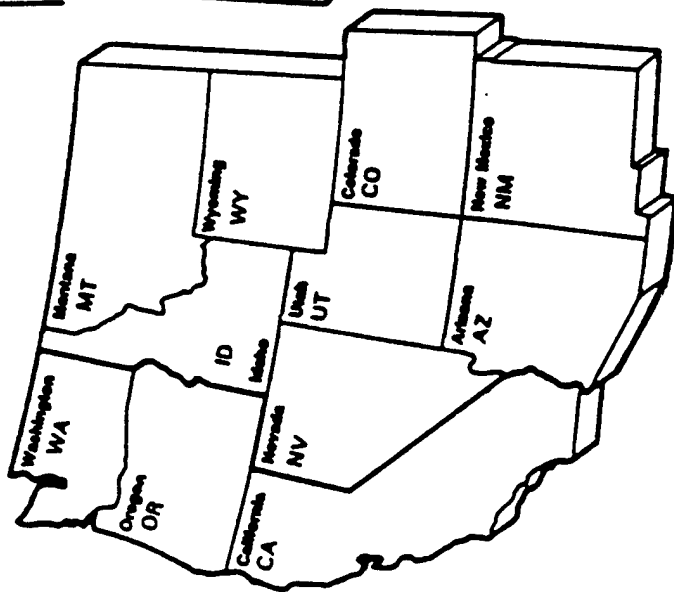
Table Ba-1. FEMP UPV* Discount Factors adjusted for fuel price escalation, by end-use sector and fuel type.^a
Discount rate = 4.1 percent (DOE)

Census Region 1 (Connecticut, Maine, Massachusetts, New Hampshire,
New Jersey, New York, Pennsylvania, Rhode Island, Vermont)

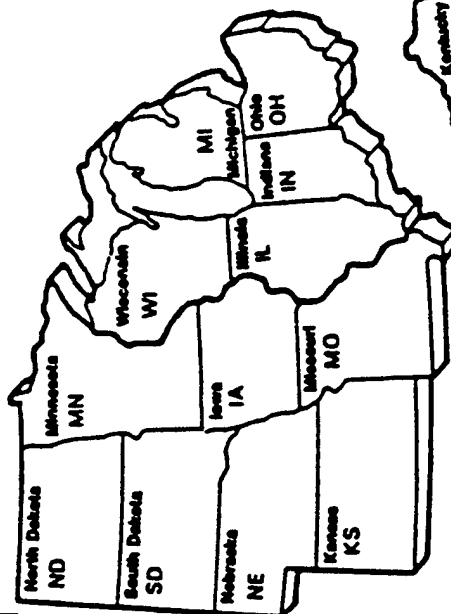
| N | RESIDENTIAL | | | COMMERCIAL | | | INDUSTRIAL | | | TRANSPORT | | | | | |
|------|-------------|-------|-------|------------|-------|-------|------------|-------|-------|-----------|-------|-------|-------|-------|-------|
| | ELEC | DIST | LPG | NTGAS | ELEC | DIST | RESID | NTGAS | COAL | ELEC | DIST | RESID | NTGAS | COAL | GASLN |
| 1 | 0.96 | 1.00 | 0.98 | 0.95 | 0.95 | 1.01 | 0.99 | 0.95 | 0.96 | 0.95 | 1.01 | 0.99 | 0.95 | 0.97 | 0.99 |
| 2 | 1.88 | 1.99 | 1.95 | 1.86 | 1.87 | 2.03 | 1.97 | 1.86 | 1.88 | 1.87 | 2.04 | 1.97 | 1.88 | 1.90 | 1.98 |
| 3 | 2.77 | 2.96 | 2.89 | 2.74 | 2.76 | 3.04 | 2.94 | 2.74 | 2.77 | 2.76 | 3.05 | 2.94 | 2.80 | 2.79 | 2.96 |
| 4 | 3.63 | 3.91 | 3.80 | 3.59 | 3.62 | 4.02 | 3.89 | 3.60 | 3.62 | 3.61 | 4.04 | 3.90 | 3.71 | 3.63 | 3.91 |
| 5 | 4.45 | 4.83 | 4.69 | 4.43 | 4.44 | 4.99 | 4.83 | 4.46 | 4.41 | 4.44 | 5.01 | 4.85 | 4.63 | 4.44 | 4.84 |
| 6 | 5.25 | 5.73 | 5.56 | 5.26 | 5.24 | 5.93 | 5.77 | 5.31 | 5.15 | 5.23 | 5.95 | 5.79 | 5.57 | 5.21 | 5.75 |
| 7 | 6.02 | 6.60 | 6.39 | 6.06 | 6.00 | 6.84 | 6.70 | 6.14 | 5.87 | 6.00 | 6.88 | 6.72 | 6.49 | 5.96 | 6.62 |
| 8 | 6.77 | 7.45 | 7.20 | 6.85 | 6.75 | 7.74 | 7.60 | 6.95 | 6.56 | 6.74 | 7.78 | 7.64 | 7.42 | 6.67 | 7.48 |
| 9 | 7.49 | 8.27 | 7.98 | 7.62 | 7.46 | 8.62 | 8.50 | 7.75 | 7.22 | 7.46 | 8.66 | 8.54 | 8.34 | 7.36 | 8.30 |
| 10 | 8.20 | 9.08 | 8.74 | 8.37 | 8.15 | 9.48 | 9.37 | 8.54 | 7.86 | 8.15 | 9.53 | 9.42 | 9.26 | 8.03 | 9.10 |
| 11 | 8.87 | 9.86 | 9.48 | 9.09 | 8.81 | 10.31 | 10.23 | 9.30 | 8.47 | 8.81 | 10.37 | 10.29 | 10.16 | 8.67 | 9.87 |
| 12 | 9.53 | 10.62 | 10.19 | 9.79 | 9.45 | 11.13 | 11.07 | 10.04 | 9.07 | 9.46 | 11.19 | 11.14 | 11.03 | 9.29 | 10.61 |
| 13 | 10.18 | 11.36 | 10.88 | 10.47 | 10.08 | 11.92 | 11.90 | 10.75 | 9.67 | 10.08 | 11.99 | 11.97 | 11.89 | 9.89 | 11.32 |
| 14 | 10.80 | 12.07 | 11.55 | 11.11 | 10.68 | 12.69 | 12.72 | 11.43 | 10.25 | 10.68 | 12.77 | 12.80 | 12.72 | 10.47 | 12.01 |
| 15 | 11.40 | 12.77 | 12.20 | 11.73 | 11.27 | 13.44 | 13.52 | 12.08 | 10.80 | 11.27 | 13.52 | 13.61 | 13.52 | 11.04 | 12.67 |
| 16 | 11.98 | 13.44 | 12.82 | 12.33 | 11.83 | 14.17 | 14.30 | 12.72 | 11.33 | 11.83 | 14.26 | 14.40 | 14.29 | 11.58 | 13.31 |
| 17 | 12.54 | 14.09 | 13.43 | 12.91 | 12.37 | 14.88 | 15.06 | 13.33 | 11.84 | 12.37 | 14.97 | 15.17 | 15.04 | 12.10 | 13.93 |
| 18 | 13.08 | 14.72 | 14.01 | 13.46 | 12.88 | 15.56 | 15.81 | 13.91 | 12.33 | 12.89 | 15.67 | 15.92 | 15.76 | 12.61 | 14.53 |
| 19 | 13.60 | 15.33 | 14.57 | 14.00 | 13.38 | 16.23 | 16.54 | 14.48 | 12.80 | 13.38 | 16.34 | 16.66 | 16.46 | 13.09 | 15.11 |
| 20 | 14.10 | 15.92 | 15.12 | 14.51 | 13.85 | 16.88 | 17.25 | 15.03 | 13.26 | 13.86 | 16.99 | 17.38 | 17.14 | 13.56 | 15.66 |
| 21 | 14.59 | 16.49 | 15.64 | 15.01 | 14.31 | 17.50 | 17.95 | 15.56 | 13.69 | 14.32 | 17.62 | 18.09 | 17.80 | 14.01 | 16.20 |
| 22 | 15.05 | 17.04 | 16.14 | 15.49 | 14.75 | 18.11 | 18.63 | 16.07 | 14.11 | 14.76 | 18.24 | 18.78 | 18.43 | 14.44 | 16.73 |
| 23 | 15.50 | 17.58 | 16.63 | 15.96 | 15.17 | 18.70 | 19.29 | 16.56 | 14.51 | 15.19 | 18.83 | 19.45 | 19.04 | 14.85 | 17.23 |
| 24 | 15.93 | 18.10 | 17.10 | 16.40 | 15.58 | 19.27 | 19.93 | 17.04 | 14.90 | 15.60 | 19.41 | 20.10 | 19.64 | 15.25 | 17.71 |
| 25 | 16.35 | 18.60 | 17.55 | 16.83 | 15.96 | 19.82 | 20.56 | 17.50 | 15.27 | 15.99 | 19.96 | 20.73 | 20.21 | 15.64 | 18.18 |
| 26/a | 16.75 | 19.08 | 17.99 | 17.25 | 16.34 | 20.35 | 21.16 | 17.94 | 15.62 | 16.37 | 20.50 | 21.35 | 20.77 | 16.01 | 18.64 |
| 27/a | 17.14 | 19.54 | 18.41 | 17.65 | 16.69 | 20.86 | 21.75 | 18.37 | 15.96 | 16.73 | 21.02 | 21.95 | 21.31 | 16.37 | 19.07 |
| 28/a | 17.51 | 19.99 | 18.81 | 18.04 | 17.04 | 21.36 | 22.33 | 18.79 | 16.29 | 17.08 | 21.53 | 22.53 | 21.83 | 16.71 | 19.49 |
| 29/a | 17.87 | 20.43 | 19.20 | 18.41 | 17.37 | 21.84 | 22.88 | 19.19 | 16.61 | 17.41 | 22.01 | 23.09 | 22.33 | 17.04 | 19.90 |
| 30/a | 18.22 | 20.84 | 19.57 | 18.78 | 17.68 | 22.31 | 23.42 | 19.57 | 16.91 | 17.73 | 22.48 | 23.64 | 22.82 | 17.36 | 20.29 |

^a UPV* factors are reported for years 26-30 to accommodate a planning/construction period of up to 5 years. (See p. 6 for instructions on use.)

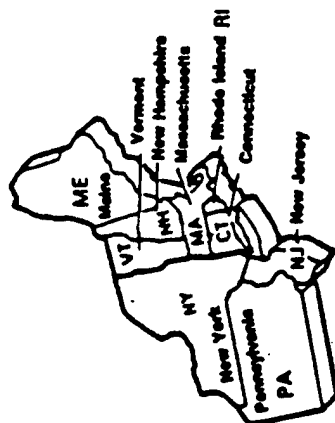
WEST (Region 4)



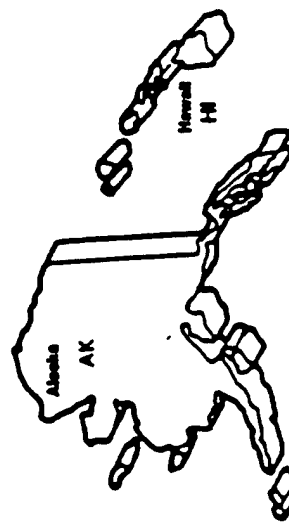
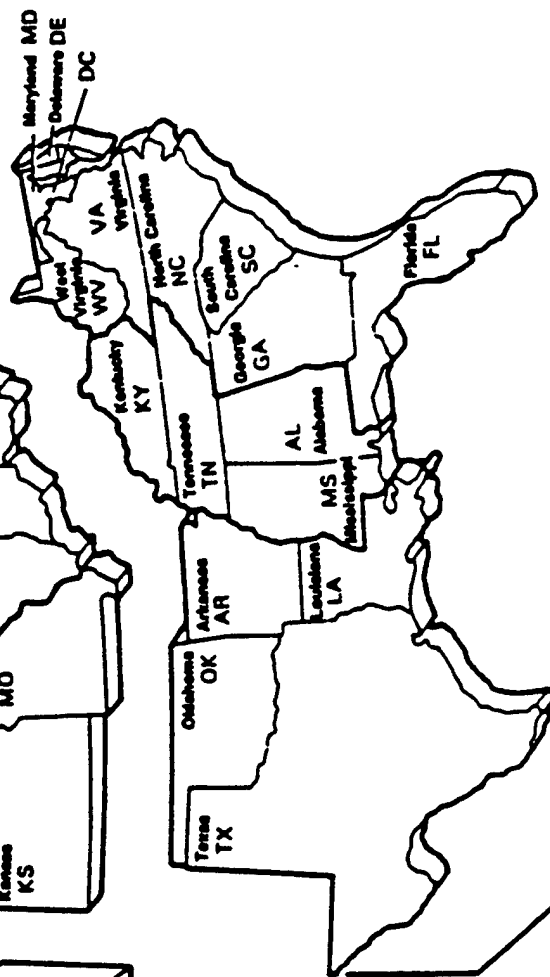
MIDWEST (Region 2)



NORTHEAST (Region 1)



SOUTH (Region 3)



Source: U.S. Bureau of the Census

Figure B-1. Map of the United States Showing Census Regions.

**Table A-2. UPV factors for finding the present value of
future annually recurring uniform costs (non-fuel)**

| Number of years from base date | Uniform Present Value (UPV) Factors | | |
|--------------------------------------|-------------------------------------|---------------------------------|--------------------------------|
| | DOE | OMB Discount Rates ^a | |
| | Discount rate 4.1% | Short term ^b 4.6% | Long Term ^c 4.9% |
| 1 | 0.96 | 0.96 | 0.95 |
| 2 | 1.88 | 1.87 | 1.86 |
| 3 | 2.77 | 2.74 | 2.73 |
| 4 | 3.62 | 3.58 | 3.55 |
| 5 | 4.44 | 4.38 | 4.34 |
| 6 | 5.23 | 5.14 | 5.09 |
| 7 | 5.98 | 5.87 | 5.81 |
| 8 | 6.71 | 6.57 | 6.49 |
| 9 | 7.40 | 7.24 | 7.14 |
| 10 | 8.07 | 7.87 | 7.76 |
| 11 | 8.71 | | 8.35 |
| 12 | 9.33 | | 8.91 |
| 13 | 9.92 | | 9.45 |
| 14 | 10.49 | | 9.96 |
| 15 | 11.04 | | 10.45 |
| 16 | 11.57 | | 10.92 |
| 17 | 12.07 | | 11.36 |
| 18 | 12.56 | | 11.78 |
| 19 | 13.02 | | 12.18 |
| 20 | 13.47 | | 12.57 |
| 21 | 13.90 | | 12.93 |
| 22 | 14.31 | | 13.28 |
| 23 | 14.71 | | 13.62 |
| 24 | 15.09 | | 13.93 |
| 25 | 15.46 | | 14.24 |
| 26 | 15.81 | | 14.52 |
| 27 | 16.15 | | 14.80 |
| 28 | 16.47 | | 15.06 |
| 29 | 16.78 | | 15.31 |
| 30 | 17.08 | | 15.55 |

^a OMB discount rates as of January 1995. OMB rates are expected to be revised in January 1996.

^b Short-term discount rate based on OMB discount rate for 7-year study period.

^c Long-term discount rate based on OMB discount rate for 30-year study period.

Table A-1. SPV factors for finding the present value of future single costs (non-fuel)

| Single Present Value (SPV) Factors | | | |
|------------------------------------|--------------------|---------------------------------|-----------------------------|
| Number of years from base date | DOE | OMB Discount Rates ^a | |
| | Discount rate 4.1% | Short term ^b 4.6% | Long Term ^c 4.9% |
| 0.25 | 0.990 | 0.989 | 0.988 |
| 0.50 | 0.980 | 0.978 | 0.976 |
| 0.75 | 0.970 | 0.967 | 0.965 |
| 1 | 0.961 | 0.956 | 0.953 |
| 2 | 0.923 | 0.914 | 0.909 |
| 3 | 0.886 | 0.874 | 0.866 |
| 4 | 0.852 | 0.835 | 0.826 |
| 5 | 0.818 | 0.799 | 0.787 |
| 6 | 0.786 | 0.764 | 0.750 |
| 7 | 0.755 | 0.730 | 0.715 |
| 8 | 0.725 | 0.698 | 0.682 |
| 9 | 0.697 | 0.667 | 0.650 |
| 10 | 0.669 | 0.638 | 0.620 |
| 11 | 0.643 | | 0.591 |
| 12 | 0.617 | | 0.563 |
| 13 | 0.593 | | 0.537 |
| 14 | 0.570 | | 0.512 |
| 15 | 0.547 | | 0.488 |
| 16 | 0.526 | | 0.465 |
| 17 | 0.505 | | 0.443 |
| 18 | 0.485 | | 0.423 |
| 19 | 0.466 | | 0.403 |
| 20 | 0.448 | | 0.384 |
| 21 | 0.430 | | 0.366 |
| 22 | 0.413 | | 0.349 |
| 23 | 0.397 | | 0.333 |
| 24 | 0.381 | | 0.317 |
| 25 | 0.366 | | 0.302 |
| 26 | 0.352 | | 0.288 |
| 27 | 0.338 | | 0.275 |
| 28 | 0.325 | | 0.262 |
| 29 | 0.312 | | 0.250 |
| 30 | 0.300 | | 0.238 |

^a OMB discount rates as of January 1995. OMB rates are expected to be revised in January 1996.

^b Short-term discount rate based on OMB discount rate for 7-year study period.

^c Long-term discount rate based on OMB discount rate for 30-year study period.

| | | | | |
|---|--|-------------------|---|-------------------|
| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | | | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum; Watertown, NY | | | 4. PROJECT TITLE Various Water Distribution Projects | |
| 5. PROGRAM ELEMENT | 6. CATEGORY CODE | 7. PROJECT NUMBER | 8. PROJECT COST (\$000) | |
| 9. COST ESTIMATES | | | | |
| ITEM | U/M | QUANTITY | UNIT COST | COST |
| FEMP: Repair Discovered Leaks | LS | | | \$35,221 |
| FEMP: Implement Leak Detection Program | LS | | | 26,000 |
| FEMP: Connect Valve Pit Actuators to Improve Stagnation | LS | | | 2,899 |
| FEMP: Reconnect Isolated Main Line to Improve Stagnation | LS | | | 10,119 |
| TOTAL CONTRACT COST | | | | 74,239 |
| SIOH (6%) | | | | 4,454 |
| DESIGN COST (6%) | | | | 4,454 |
| TOTAL PROJECT COST | | | | 83,148 |
| TOTAL REQUEST (ROUNDED) | | | | 84,000 |
| 10. DESCRIPTION OF PROPOSED CONSTRUCTION | | | | |
| <p>This project consists of the following separate tasks proposed for the water distribution system at Ft. Drum:</p> <ul style="list-style-type: none"> • Repair seventeen leaks discovered by a leak detection survey performed on the water distribution piping system. These leaks consist of one main line leaks, two service line leaks, one valve leak, and thirteen fire hydrant leaks. The total leakage savings that can be claimed by repairing these leaks was estimated at 169,000 gallons per day (61,685,000 gallons per year). • Implement a water audit and leak detection program for approximately 130 miles of water distribution piping. • Provide labor hours to connect existing water valve actuators to the telemetry system. Automatic control of valves connecting the old and new Posts will allow for improved circulation, thus alleviating stagnation problems which occur in areas of the old Post. • Approximately 1,200 LF of a 12" main line located in Area 1000 of the old Post is isolated from the water distribution system. Reinstatement of this line will allow for improved water circulation in the system. | | | | |
| 11. REQUIREMENT: | | | | |
| <p>Project: This Federal Energy Management Program (FEMP) project will:</p> <ul style="list-style-type: none"> • Repair seventeen water distribution leaks discovered during a leak detection survey performed in November 1995. • Implement a leak detection program for the water distribution system at Ft. Drum. • Connect existing valve pit actuators to the telemetry system to improve stagnation problems in the western end of the old Post. • Reconnect an isolated 12" water main line in Area 1000 to improve water circulation in the old Post. | | | | |
| <p>Requirement: This project is required to reduce water distribution leakage and use at Ft. Drum. A reduction of leakage and use in the water distribution system would result in immediate energy and maintenance savings.</p> | | | | |
| <p>Current Situation: Ft. Drum pumps approximately 709,300,000 gallons of water per year into the water distribution system. Water is currently lost in the form of leakage or manual release from fire hydrants to improve stagnation problems. Water is lost in the following forms:</p> | | | | |
| <ul style="list-style-type: none"> • A leak detection survey has revealed that about 61,685,000 gallons of water (8.7% of total usage) is currently being lost in the form of leakage. The estimated leakage quantity is made up of one main line leak (46,625,000 gallons per year), two service line leaks (10,585,000 gallons per year), one valve leak (730,000 gallons per year), and thirteen hydrant leaks (4,745,000 gallons per year). | | | | |

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| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum; Watertown, NY | | |
| 4. PROJECT TITLE Various Water Distribution Projects | | 5. PROJECT NUMBER |
| <p>Current Situation: (cont.)</p> <ul style="list-style-type: none"> • A water audit has calculated that about 62,620,615 gallons per year is in the form of leakage that can be recovered. This matches well with the amount of actual leakage uncovered during the leak detection survey. • It was estimated that 396,000 gallons per year are annually released from hydrants to improve stagnation problems in the western end of the old Post. • It was estimated that 132,000 gallons per year are annually released from hydrants to improve stagnation problems in Area 1000 of the old Post. <p>Impact If Not Provided: Failure to implement this project will cause Ft. Drum to not realize a \$73,618 annual savings with a 1.13 year simple payback and a savings-to-investment ratio of 11.94.</p> <p>Supporting Documentation: Results of the leak detection survey and water audit, as well as basic engineering calculations which present energy and cost savings are documented in a report under COE Contract No. DACA01-94-D-0033, performed by an A/E firm in FY96.</p> <p>Verification of Savings: Detailed annual water production and maintenance costs are recorded by Ft. Drum. The production rate of water at Ft. Drum is recorded from an existing telemetry system. These meters are able to collect various data from the water distribution system in increments as short as every five minutes. Historic data was obtained for the period of October 1993 through September 1995 as a basis for the report mentioned above. Annual water production and maintenance costs, as well as the quantity of water produced for the period after the projects are implemented, can be compared to historical data. Assuming that water demand at Ft. Drum will remain fairly constant, the amount of water saved in repairing the leakage and reducing use should be the difference.</p> <p>Amount of Water Conserved: The amount of water conserved is estimated to be 124,834,000 gallons per year.</p> <p style="text-align: center;">ECONOMIC ANALYSIS: REPAIR DISCOVERED LEAKS</p> <p>A leak detection survey was performed on water distribution piping during November 1995 at Ft. Drum, New York. By the direction of Ft. Drum personnel, a total of 130 miles of piping was surveyed. The water surveyor used a combination of listening devices and preamplified-transducer systems to identify and locate the majority of leaks.</p> <p>Seventeen leaks were located during the survey. Some nonvisible leaks were excavated and inspected. Leakage quantities were estimated by the technician based on the size of the leak, size of the pipe, pressure in the pipe and measurement techniques recommended by the American Water Works Association (AWWA). The total estimated leakage quantity of 169,000 gallons per day was comprised of the following:</p> <ul style="list-style-type: none"> • One main line leak estimated at 125,000 gallons per day • Two service line leak estimated at 29,000 gallons per day • One valve leak estimated at 2,000 gallons per day • Thirteen fire hydrant leaks estimated at 13,000 gallons per day <p>A detailed list of the leaks discovered by the leak detection survey can be found on page 7 of this report.</p> <p>The cost savings associated with repairing the leakage was calculated. The total cost savings equals the quantity of water saved by repairing the discovered leakage multiplied by the cost of water per gallon. The cost of water at Ft. Drum is a combination of several factors:</p> <ul style="list-style-type: none"> • Ft. Drum Well Electrical Charges. Ft. Drum utilizes eleven wells with electrical motors ranging in size from 15 to 40 horsepower. These wells collectively operate for an average of 16,515 hours per year. Based on a total annual water production of 180,282,960 gallons, the total electrical cost of the water produced from the wells is \$0.097 per thousand gallons. | | |

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| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum; Watertown, NY | | |
| 4. PROJECT TITLE Various Water Distribution Projects | | 5. PROJECT NUMBER |
| ECONOMIC ANALYSIS (cont.) <ul style="list-style-type: none"> • Ft. Drum Operation & Maintenance (O&M) Costs. These costs include the labor costs associated with operating and maintaining the water distribution system and the water treatment plant, and includes chemical treatment costs. The annual costs for O&M, provided by Ft. Drum personnel, was divided by the total quantity of water produced for Ft. Drum to obtain an O&M cost of <u>\$0.031 per thousand gallons.</u> • Ground Reservoir Pump Electrical Costs. There are two pumps which serve a 750,000 gallon ground reservoir. One pump, 40 hp, is used to circulate water through the reservoir. The other pump, 75 hp, is necessary to maintain water volume in the reservoir in case of excessive demand. The cost was calculated by taking the total annual energy consumption costs for these pumps divided by the total annual water production. Annual energy consumption was calculated based on pump operating schedules and electrical rate data provided by Ft. Drum personnel. Water consumption was based on telemetry data provided by Ft. Drum personnel. The electrical cost was calculated to be <u>\$0.067 per thousand gallons.</u> • Development of the North Country (DANC) Costs. Ft. Drum contractually pays for a minimum 1.5 mgd of water from the DANC. The cost of the water is comprised of fixed and variable costs incurred by the DANC and the City of Watertown. The fixed costs are the capital costs incurred to build the pipeline from the City of Watertown to Ft. Drum, as well as a water booster station, which is located in the old Post. Variable costs include those costs which vary according to the amount of water produced, such as operation, maintenance and overhead charges. It was assumed that any water savings resulting from implementation of the ECOs would only result in variable cost savings. Ft. Drum is contractually obligated to pay for the fixed capital costs. Based on variable costs provided by the DANC, the cost of water provided by the DANC is <u>\$0.90 per thousand gallons.</u> <p>A detailed cost estimate was performed to determine the cost of repairing the leaks. Costs for necessary site work were included with the repair and replacement costs.</p> <p>A life cycle cost analysis was performed to determine the economic feasibility of repairing the leaks over a 20 year economic life. The economic analysis was based upon the leakage quantities identified by the leak detection survey.</p> <p>A summary of the life cycle cost analysis, along with a summary of the leaks located by the leak detection survey, is provided in the backup calculations.</p> <p style="text-align: center;">ECONOMIC ANALYSIS: IMPLEMENT LEAK DETECTION PROGRAM</p> <p>A water audit was performed on the water distribution system at Ft. Drum according to the guidelines set by American Water Works Association (AWWA) Manual 36, entitled "Water Audits and Leak Detection". The audit was based on information supplied by Ft. Drum personnel. Water usage at Ft. Drum can be separated into the following categories:</p> <ul style="list-style-type: none"> • Domestic Water Consumption. The amount of water consumed by all military and civilian occupants of Ft. Drum was estimated. Demographic data, obtained from Ft. Drum personnel, provided the number of people who use and occupy the base. These demographics, taken from the Total Army Quality Self-Assessment (1995), were separated into active duty military and civilian personnel, family members, military retirees, and reserve component personnel. According to guidelines in the Army Technical Manual TM 5-813-1, "Water Supply Sources and General Considerations", the design allowances for water consumption are 150 gallons per day (gpd) per person for residents and 50 gpd for non-residents. Multiplying these design allowances by the number of residents and non-residents produces an estimate of the amount of water consumed for domestic use. | | |

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|--|--|--|-------------------|
| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum; Watertown, NY | | | |
| 4. PROJECT TITLE Various Water Distribution Projects | | | 5. PROJECT NUMBER |
| ECONOMIC ANALYSIS (cont.) <ul style="list-style-type: none"> • Metered Water Usage. Water usage for specific buildings on Post, such as the PX, Commissary, and the steam central plant, is metered. Ft. Drum personnel provided meter data for 15 specific buildings for the past two years. The average water usage over the last two years was used for the water audit. It was assumed for this study that the metered water usage is separate from the domestic water consumption value. • Fire Hydrants. According to Ft. Drum personnel, water is consumed through fire hydrants for two purposes, fire protection and maintenance. Because no specific data was available on the amount of water consumed, estimates for water usage were made based on water requirements provided by Ft. Drum personnel. • Once-through Cooling Units. Domestic water is used for cooling in the condenser units of six HVAC and refrigeration units throughout the Post. The amount of water used by these units was provided by Ft. • Irrigation Water. From mid-May to September, water from the distribution system is used to irrigate the lawns at the headquarters buildings, parade fields, and athletic fields at Ft. Drum. The estimation of the total amount of water consumed was based on estimating the number of sprinkler heads that serve each area, the flow produced by each sprinkler head, and the amount of time required for each sprinkler cycle. • Discovered Leaks. According to Ft. Drum personnel, no documented water main breaks have occurred in the water distribution system over the past two years. Therefore, water loss attributed to discovered water main breaks was assumed to be negligible. <p>The results of the water audit are given on page 8. The amount of recoverable leakage, which is estimated as 75% of the potential water system leakage, was calculated to be 62,620,615 gallons per year. This value represents approximately 9% of Ft. Drum's total water production.</p> <p>The total beneficial cost of performing a leak detection survey to recover leakage from the water distribution system was assumed to be only the costs that vary with the amount of water delivered. These include the production, maintenance and energy costs. The cost of leak repair is not included. According to AWWA Manual 36, because leaks are continually discovered and repaired in the normal course of operations, the leaks found in the leak detection program would be repaired eventually. If the leaks are repaired as part of a leak detection program, as is Ft. Drum's policy, the expense of repairing leaks as they are accidentally discovered is avoided. Although some cost savings would be realized in fixing the leaks when they are discovered by a leak detection program, as opposed to discovering them accidentally, AWWA Manual 36 allows the auditor to assume that the savings is negligible.</p> <p>The total payback of the leak detection program was calculated by dividing the total cost of the leak detection program by the cost savings of recovering leakage. The total cost of the leak detection survey was taken from the average cost of previous leak detection surveys in the region and from cost information provided by AWWA. The cost of leak detection was given as \$200 per mile of pipe surveyed. Approximately 130 miles of piping in the water distribution system would need to be investigated.</p> <p>A summary of the water audit, along with the LCCA, is provided on the following pages.</p> <p style="text-align: center;">ECONOMIC ANALYSIS: CONNECT VALVE PIT ACTUATORS</p> <p>Ft. Drum is currently experiencing problems with stagnating water and low chlorine residuals in the western portion of the old Post (specifically Areas 0, 100, 1100, 4000, and 6000). The stagnation problems are thought to arise from two</p> | | | |

| | | |
|---|--|-------------------|
| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum; Watertown, NY | | |
| 4. PROJECT TITLE Various Water Distribution Projects | | 5. PROJECT NUMBER |
| <p>ECONOMIC ANALYSIS (cont.)</p> <p>conditions. The first condition is the decreased flow of water through the old Post. The low water demand has been created from the shift of activity at Ft. Drum from the old Post to the new Post. The lower demand slows the turnover rate of water in the lines in that area, creating stagnated water. Secondly, most of the flow between the Posts occurs through Valve Vault #3, which is attached to a 20" main line on the east side of the old Post. There is an additional valve vault, Vault #4, that is connected to a 16" main line which directs water through the western end of the Post. The electric actuators and control valves have already been installed in the 16" line, but the actuators have not been connected to the telemetry system. The valves in Valve Vault #4 are currently closed, thereby creating a short circuit condition in the flow of water between the Posts, especially along the western end of the old Post. By connecting the actuators to the existing telemetry system, Ft. Drum personnel can automatically alternate or combine water flows through Valve Vaults #3 and #4, thus improving water circulation problems.</p> <p>The amount of water annually lost for the purpose of improving stagnation in the water distribution system was estimated. The estimate was based on data provided by Ft. Drum personnel as to the number of times that fire hydrants are exercised in the western end of the old Post to improve stagnation problems. The cost of water lost was determined by multiplying the amount of water lost, by the cost of water (per thousand gallons) at Ft. Drum, which was explained previously.</p> <p>A cost estimate was performed to calculate the cost of implementing this project. The FM and hardware connections required to connect the actuators in Valve Vault #4 to the telemetry system have already been procured. Only labor is required to complete the connection.</p> <p>A life cycle cost analysis was performed to determine the economic feasibility of implementing this ECO. Cost savings was based upon the estimated quantity of water saved from hydrant exercising each year. A summary of the LCCA is provided on the following pages.</p> <p style="text-align: center;">ECONOMIC ANALYSIS: RECONNECT ISOLATED MAIN LINE</p> <p>Approximately 1,200 LF of a 12" main line located in Area 1000 is isolated from the water distribution system, the result of repair work performed a few years ago. This section of piping is one of six main lines that transport water from the water treatment plant to the old Post. Hydraulic and stagnation problems exist because water is forced through the other mains, thus bypassing the area served directly by this 12" line.</p> <p>The amount of water annually lost for the purpose of improving stagnation in this particular area was estimated. The estimate was based on data provided by Ft. Drum personnel as to the number of times that fire hydrants are exercised in Area 1000 to improve stagnation problems. The cost of water lost was determined by multiplying the amount of water lost, by the cost of water (per thousand gallons) at Ft. Drum, which was explained previously.</p> <p>A cost estimate was performed to determine the cost of reinstating the water line back into the distribution system. The estimate included site work and mechanical costs required to connect both ends of the isolated pipe, as well as the cost to connect a fire hydrant to each end to allow for proper flushing of the line.</p> <p>A life cycle cost analysis was performed to determine the economic feasibility of implementing this ECO. Cost savings was based upon the estimated quantity of water saved from hydrant exercising each year. A summary of the LCCA is provided on the following pages.</p> | | |

| | | | | | |
|--|--|--|--|-------------------|-------------------|
| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | | | | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum, NY | | | | | |
| 4. PROJECT TITLE Water Conservation Study | | | | 5. PROJECT NUMBER | |

| LIFE CYCLE COST ANALYSIS SUMMARY | | | | | |
|---|----------------------|----------------------|--|--|--|
| ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) | | | | | |
| LOCATION: Ft. Drum, NY | REGION: 1 (New York) | PROJECT NO: 1406-012 | | | |
| PROJECT TITLE: Water Conservation Study | | FISCAL YEAR: 1996 | | | |
| ANALYSIS DATE: 05/13/96 | ECONOMIC LIFE: 20 | PREPARED BY: TCP | | | |

1. INVESTMENT: **ECO #9 - Ft. Drum Water Projects**

| | | |
|--|------------------|-----------------|
| A. CONSTRUCTION COST | = | \$74,239 |
| B. SIOH COST | (6.0% of 1A) = | \$4,454 |
| C. DESIGN COST | (6.0% of 1A) = | \$4,454 |
| D. TOTAL COST | (1A + 1B + 1C) = | \$83,148 |
| E. SALVAGE VALUE OF EXISTING EQUIPMENT | = | \$0 |
| F. PUBLIC UTILITY COMPANY REBATE | = | |
| G. TOTAL INVESTMENT | (1D - 1E - 1F) = | -----> \$83,148 |

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-10 USED FOR DISCOUNT FACTORS: OCT 1995

| ENERGY SOURCE | FUEL COST \$/KGAL (1) | SAVINGS KGAL/YR (2) | ANNUAL \$ SAVINGS (3) | DISCOUNT FACTOR (4) | DISCOUNTED SAVINGS (5) |
|---------------|-----------------------|---------------------|-----------------------|---------------------|------------------------|
| A. ELECTRICAL | \$0.025 | 124,834 | \$3,121 | 13.86 | \$43,255 |
| B. DIST | \$0.00 | 0 | \$0 | 16.99 | \$0 |
| C. RESID | \$0.00 | 0 | \$0 | 17.38 | \$0 |
| D. NAT GAS | \$0.00 | 0 | \$0 | 17.14 | \$0 |
| E. COAL | \$0.00 | 0 | \$0 | 13.56 | \$0 |
| F. TOTAL | | 124,834 | \$3,121 | | -----> \$43,255 |

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-) Unit Cost * 124,834 KGAL

| | | | |
|---|------------|-------|-------------|
| 1 DANC Variable Savings (\$0.67/KGAL) | \$83,888 | 13.47 | \$1,129,977 |
| 2 Ft. Drum O&M Savings (\$0.028/KGAL) | \$3,495 | 13.47 | \$47,082 |
| 3 Ft Drum Chemical Savings (\$0.031/KGAL) | \$3,870 | 13.47 | \$52,127 |
| 4 Reservoir Savings (\$0.067/KGAL) | \$8,364 | 13.47 | \$112,661 |
| 5 Annual Leak Detection Cost | (\$29,120) | 13.47 | (\$392,246) |
| 6 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-) | \$70,498 | | \$949,602 |

B. NON-RECURRING (+/-)

| ITEM | SAVINGS (+) COST(-) (1) | YEAR OF OCCURRENCE (2) | DISCOUNT FACTOR (3) (TABLE A-2) | DISCOUNTED SAVINGS/ COST (4) |
|----------|-------------------------|------------------------|---------------------------------|------------------------------|
| a. | | | | \$0 |
| b. | | | | \$0 |
| c. TOTAL | \$0 | | | \$0 |

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A6 + 3Bc4) = \$949,602

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-) (2F3 + 3A + (3Bc1/Economic Life)) \$73,618

5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY) (1G/4) = 1.13

6. TOTAL NET DISCOUNTED SAVINGS (2H5 + 3C) = \$992,857

7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (6/1G) = 11.94

(MUST HAVE SIR > 1.25 TO QUALIFY)

PREVIOUS EDITIONS MAY BE USED INTERNALLY

| | | |
|--|--|-------------------|
| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum, NY | | |
| 4. PROJECT TITLE Water Conservation Study | | 5. PROJECT NUMBER |

DISCOVERED LEAKS AT FT. DRUM

| LEAK NO. | TYPE OF LEAK | LOCATION/ DESCRIPTION | SIZE (GPD) | PIPE/VALVE SIZE ADDITIONAL COMMENTS |
|----------|--------------|--|------------|--|
| 1-1 | Service Line | Building #9224 | 14,000 | |
| 1-2 | Fire Hydrant | Memorial Drive at South Entrance to Commissary | 1,000 | Leak noise quit when hydrant was tightened |
| 2-1 | Fire Hydrant | At Building #10270 | 1,000 | Leak noise quit when hydrant was tightened |
| 2-2 | Fire Hydrant | Fourth Street East | 1,000 | Leak noise quit when hydrant was tightened |
| 2-3 | Valve | Fourth Street East at 4th Armored Division | 2,000 | |
| 2-4 | Fire Hydrant | Fourth Street East at 4th Armored Division | 1,000 | Leak noise quit when hydrant was tightened |
| 2-5 | Fire Hydrant | Memorial Drive | 1,000 | Leak noise quit when hydrant was tightened |
| 2-6 | Valve | Fourth Street East at Lake Garda Lane | 5,000 | Leak noise quit when valve was tightened |
| 2-7 | Fire Hydrant | Building #10050 | 1,000 | Leak noise quit when hydrant was tightened |
| 2-8 | Fire Hydrant | Riva Ridge, North Loop | 1,000 | Leak noise quit when hydrant was tightened |
| 2-9 | Fire Hydrant | Memorial Drive at 45th Infantry Division Drive | 1,000 | Leak noise quit when hydrant was tightened |
| 2-10 | Fire Hydrant | Motor Pool Building #10173 | 1,000 | Leak noise quit when hydrant was tightened |
| 2-11 | Fire Hydrant | Memorial Drive at 2nd Street | 1,000 | Leak noise quit when hydrant was tightened |
| 3-1 | Fire Hydrant | Building #4325 | 1,000 | Leak noise quit when hydrant was tightened |
| 3-2 | Fire Hydrant | Building #4485 | 1,000 | Leak noise quit when hydrant was tightened |
| 4-1 | Fire Hydrant | Rail Road Street at Oswego Avenue | 1,000 | |
| 4-2 | Fire Hydrant | Rail Road Street at Lewis Avenue | 1,000 | |
| 4-3 | Fire Hydrant | Building #T-145 | 1,000 | |
| 4-4 | Fire Hydrant | First Street East at Nash Blvd. | 1,000 | |
| 4-5 | Fire Hydrant | Second Street at St. Lawrence Avenue | 1,000 | |
| 4-6 | Fire Hydrant | Second Street at Lewis Avenue | 1,000 | |
| 4-7 | Fire Hydrant | Pine Lane, Building #T-2256 | 1,000 | |
| 5-1 | Fire Hydrant | George Street at Cannon Avenue | 1,000 | |
| 5-2 | Fire Hydrant | Cannon Avenue at Delahanty Street | 1,000 | |
| 5-3 | Service Line | Building #T-2315 | 15,000 | 1-1/2" service line |
| 5-4 | Fire Hydrant | Lewis Avenue, Building #T-1050 | 1,000 | |
| 5-5 | Fire Hydrant | Nash Blvd., Building #T-1004 | 1,000 | |
| 5-6 | Main Line | Hospital Area, Building #T-2473 | 125,000 | 12" main line connected to old 2" service |
| 5-7 | Fire Hydrant | Coyler Drive at Dunn Avenue | 1,000 | |
| 6-1 | Fire Hydrant | Airport Access Road, across from Bldg. #2074 | 1,000 | |
| 7-1 | Fire Hydrant | Building #8527 | 1,000 | Leak noise quit when hydrant was tightened |

LEAK SUMMARY

| Leak Type | No. of Leaks | Size (GPD) | Size (KGal/Yr) |
|-----------------|--------------|------------|----------------|
| Main Line | 1 | 125,000 | 45,625 |
| Service Line | 2 | 29,000 | 10,585 |
| Valve | 1 | 2,000 | 730 |
| Valve (Fixed) | 1 | 5,000 | 1,825 |
| Fire Hydrant | 13 | 13,000 | 4,745 |
| Hydrant (Fixed) | 13 | 13,000 | 4,745 |
| Total Leakage | 17 | 169,000 | 61,685 |
| Leakage (Fixed) | 14 | 18,000 | 6,570 |
| Total | 31 | 187,000 | 68,255 |

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UNTIL EXHAUSTED

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1 DEC 76

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PAGE NO. 7

| | | |
|--|--|-------------------|
| 1. COMPONENT ARMY | FY 1996 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE Apr-96 |
| 3. INSTALLATION AND LOCATION Ft. Drum, NY | | |
| 4. PROJECT TITLE Water Conservation Study | | 5. PROJECT NUMBER |

WATER AUDIT

| | Gallons/Year |
|--|--------------------|
| Total Amount of Water Available (Flow into system minus storage): | 709,300,653 |
| Water Uses (From annual average data from 1994-1995 provided by Ft. Drum): | |
| Domestic Water Consumption: | = 596,420,000 |
| Metered Water Users: | = 17,308,500 |
| Fire Hydrants (Fire Protection): | = 576,000 |
| Fire Hydrants (Maintenance): | = 528,000 |
| Once-through Cooling Units: | = 6,450,000 |
| Landscaping/Irrigation: | = <u>4,524,000</u> |
| Total Identified Water Consumed: | 625,806,500 |
| Potential Water System Losses: | 83,494,153 |
| Recoverable Leakage (AWWA Manual 36 estimates 75% is recoverable): | 62,620,615 |
| Cost of Water Supply (per 1000 gallons): | \$0.82 |
| One Year Benefit from Recoverable Leakage: | \$51,349 |
| Total Cost of Leak Detection Program: \$200 / mile x 130 miles | = \$26,000 |
| Benefit to Cost Ratio: | 1.97 |
| Simple Payback (years): | 0.51 |

PREVIOUS EDITIONS MAY BE USED INTERNALLY
UNTIL EXHAUSTED

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | SHEET | 1 | OF | 3 |
|-------------------------------------|---------------------------|-----------------|------|-----------------------|-------|------------------|-------|----------------|-------|------------|---------|-----------|-------|
| AREA | | ACTIVITY | | LOCATION | | AMENDMENT NO. | | | | | | | |
| PROJECT TITLE | | DESCRIPTION | | CONTRACT NO. | | DACA01-94-D-0033 | | | | | | | |
| WATER CONSERVATION STUDY | | FIX ALL LEAKS | | | | | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | | | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total |
| 1 | MAIN LINE LEAK REPAIR | | | | | | | | | | | | |
| 2 | EXCAVATION | CY | 24 | \$0.00 | \$0 | \$1.56 | \$37 | \$1.58 | \$38 | \$3 | \$75 | | |
| 3 | DEWATERING | DAY | 1 | \$0.00 | \$0 | \$71.00 | \$71 | \$8.05 | \$8 | \$79 | \$79 | | |
| 4 | PATCH PIPE LEAK | EA | 1 | \$200.00 | \$200 | \$130.00 | \$130 | \$0.00 | \$0 | \$330 | \$330 | | |
| 5 | CRUSHED ROCK BEDDING | CY | 4 | \$13.00 | \$52 | \$3.43 | \$14 | \$1.39 | \$6 | \$18 | \$71 | | |
| 6 | BACKFILL | CY | 20 | \$0.00 | \$0 | \$0.71 | \$14 | \$0.58 | \$12 | \$1 | \$26 | | |
| 7 | COMPACTION | CY | 24 | \$0.00 | \$0 | \$0.86 | \$21 | \$0.33 | \$8 | \$1 | \$29 | | |
| 8 | TOTAL - ONE MAIN LEAK | | 1 | | \$252 | | \$287 | | \$71 | | \$610 | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 11 | SERVICE LINE LEAK REPAIR | | | | | | | | | | | | |
| 12 | EXCAVATION | CY | 18 | \$0.00 | \$0 | \$1.56 | \$28 | \$1.58 | \$28 | \$3 | \$57 | | |
| 13 | DEWATERING | DAY | 1 | \$0.00 | \$0 | \$71.00 | \$36 | \$8.05 | \$4 | \$79 | \$40 | | |
| 14 | PATCH PIPE LEAK | EA | 1 | \$200.00 | \$200 | \$130.00 | \$130 | \$0.00 | \$0 | \$330 | \$330 | | |
| 15 | CRUSHED ROCK BEDDING | CY | 3 | \$13.00 | \$39 | \$3.43 | \$10 | \$1.39 | \$4 | \$18 | \$53 | | |
| 16 | BACKFILL | CY | 15 | \$0.00 | \$0 | \$0.71 | \$11 | \$0.58 | \$9 | \$1 | \$19 | | |
| 17 | COMPACTION | CY | 18 | \$0.00 | \$0 | \$0.86 | \$15 | \$0.33 | \$6 | \$1 | \$21 | | |
| 18 | TOTAL - ONE SERVICE LEAK | | 1 | | \$239 | | \$230 | | \$51 | | \$520 | | |
| 19 | TOTAL - TWO SERVICE LEAKS | | 2 | | \$478 | | \$460 | | \$103 | | \$1,041 | | |
| 20 | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | DATE | | | | | | | |
| TCP | | | | E M C Engineers, Inc. | | 4/26/96 | | | | | | | |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | | |
|-------------------------------------|---------------------------|-----------------|--------------------------|-----------------------|------------------|------------|---------|----------------|---------|------------|----------|
| AREA | | ACTIVITY | LOCATION FT. DRUM, NY | | SHEET | | 2 | | OF | 3 | |
| | | | | | AMENDMENT NO. | | | | | | |
| PROJECT TITLE | | | DESCRIPTION | | CONTRACT NO. | | | | | | |
| WATER CONSERVATION STUDY | | | FIX ALL LEAKS | | DACA01-94-D-0033 | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total |
| 1 | REPLACE LEAKING VALVE | | | | | | | | | | |
| 2 | EXCAVATION | CY | 18 | \$0.00 | \$0 | \$1.56 | \$28 | \$1.58 | \$28 | \$3.14 | \$57 |
| 3 | DEWATERING | DAY | 0.5 | \$0.00 | \$0 | \$71.00 | \$36 | \$8.05 | \$4 | \$79.05 | \$40 |
| 4 | VALVE DEMOLITION, TO 8" | EA | 1 | \$0.00 | \$0 | \$30.00 | \$30 | \$0.00 | \$0 | \$30.00 | \$30 |
| 5 | GATE VALVE, 04" | EA | 1 | \$270.00 | \$270 | \$108.00 | \$108 | \$0.00 | \$0 | \$378.00 | \$378 |
| 6 | CRUSHED ROCK BEDDING | CY | 3 | \$13.00 | \$39 | \$3.43 | \$10 | \$1.39 | \$4 | \$17.82 | \$63 |
| 7 | BACKFILL | CY | 15 | \$0.00 | \$0 | \$0.71 | \$11 | \$0.58 | \$9 | \$1.29 | \$19 |
| 8 | COMPACTION | CY | 18 | \$0.00 | \$0 | \$0.86 | \$15 | \$0.33 | \$6 | \$1.19 | \$21 |
| 9 | REPAIR VALVE LEAKS | | 1 | | \$309 | | \$238 | | \$51 | | \$598 |
| 10 | | | | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | HYDRANT REPLACEMENT | | | | | | | | | | |
| 13 | EXCAVATION | CY | 24 | \$0.00 | \$0 | \$1.56 | \$37 | \$1.58 | \$38 | \$3.14 | \$75 |
| 14 | HYDRANT DEMOLITION | EA | 1 | \$0.00 | \$0 | \$102.00 | \$102 | \$0.00 | \$0 | \$102.00 | \$102 |
| 15 | PIPE REMOVAL, TO 12" DIA. | LF | 10 | \$0.00 | \$0 | \$3.43 | \$34 | \$1.39 | \$14 | \$4.82 | \$48 |
| 16 | HYDRANT | EA | 1 | \$1,250.00 | \$1,250 | \$129.00 | \$129 | \$21.50 | \$22 | \$1,400.50 | \$1,401 |
| 17 | THRUST BLOCK | CY | 1 | \$81.50 | \$81 | \$110.10 | \$83 | \$0.00 | \$0 | \$191.60 | \$144 |
| 18 | BACKFILL | CY | 20 | \$0.00 | \$0 | \$0.71 | \$14 | \$0.58 | \$12 | \$1.29 | \$26 |
| 19 | CRUSHED ROCK BEDDING | CY | 4 | \$13.00 | \$52 | \$3.43 | \$14 | \$1.39 | \$6 | \$17.82 | \$71 |
| 20 | COMPACTION | CY | 24 | \$0.00 | \$0 | \$0.86 | \$21 | \$0.33 | \$8 | \$1.19 | \$29 |
| 21 | TOTAL - ONE HYDRANT | | 1 | | \$1,363 | | \$434 | | \$98 | | \$1,895 |
| 22 | REPLACE 13 HYDRANTS | | 13 | | \$17,721 | | \$5,640 | | \$1,279 | | \$24,640 |
| 23 | | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | DATE | | | | | |
| TCP | | | | E M C Engineers, Inc. | | 4/26/96 | | | | | |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | |
|-------------------------------------|--------------------------|-----------------|------|-----------------------|----------|------------------|----------|----------------|----------|
| AREA | | ACTIVITY | | LOCATION | | SHEET | | 3 | |
| | | | | FT. DRUM, NY | | AMENDMENT NO. | | OF | |
| PROJECT TITLE | | DESCRIPTION | | CONTRACT NO. | | DACA01-94-D-0033 | | | |
| WATER CONSERVATION STUDY | | FIX ALL LEAKS | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total |
| 1 | | | | | | | | | |
| 2 | MAIN LINE LEAK REPAIR | EA | 1 | | \$252 | | \$287 | | \$71 |
| 3 | SERVICE LINE LEAK REPAIR | EA | 2 | | \$239 | | \$460 | | \$1,041 |
| 4 | REPLACE LEAKING VALVE | EA | 1 | | \$309 | | \$238 | | \$51 |
| 5 | HYDRANT REPLACEMENT | EA | 13 | | \$1,363 | | \$5,640 | | \$1,895 |
| 6 | | | | | | | | | \$24,640 |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |
| 17 | CONSTRUCTION SUBTOTAL | | | | \$18,760 | | \$6,625 | | \$1,504 |
| 18 | LOCATION FACTOR | % | | | \$15,345 | 111.80% | \$7,407 | 100.00% | \$1,504 |
| 19 | OVERHEAD & BOND | % | 20 | | \$3,069 | | \$1,481 | | \$301 |
| 20 | SUBTOTAL | | | | \$18,414 | | \$8,889 | | \$1,805 |
| 21 | PROFIT | % | 10 | | \$1,841 | | \$889 | | \$180 |
| 22 | SUBTOTAL | | | | \$20,256 | | \$9,777 | | \$1,985 |
| 23 | CONTINGENCY | % | 10 | | \$2,026 | | \$978 | | \$199 |
| 24 | GRAND TOTAL | | | | \$22,281 | | \$10,765 | | \$2,184 |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | DATE | | | |
| TCP | | | | E M C Engineers, Inc. | | 4/26/96 | | | |

| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | |
|-------------------------------------|----------------------------|-----------------|-------------------------|-----------------------|------------------|------------|---------|----------------|---------|------------|
| AREA | | ACTIVITY | LOCATION | | SHEET 1 OF 1 | | | | | |
| | | | FT. DRUM, NY | | AMENDMENT NO. | | | | | |
| PROJECT TITLE | | | DESCRIPTION | | CONTRACT NO. | | | | | |
| WATER CONSERVATION STUDY | | | CONNECT VALVE ACTUATORS | | DACA01-94-D-0033 | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | |
| 1 | CONNECT VALVE ACTUATORS | | | | | | | | | |
| 2 | LABOR HOURS - TANK 3 | HRS | 30 | \$0.00 | \$0 | \$29.30 | \$864 | \$0.00 | \$0 | \$864 |
| 3 | LABOR HOURS - VALVE PIT #4 | HRS | 30 | \$0.00 | \$0 | \$29.30 | \$864 | \$0.00 | \$0 | \$864 |
| 4 | LABOR HOURS - T-4000 PANEL | HRS | 30 | \$0.00 | \$0 | \$29.30 | \$864 | \$0.00 | \$0 | \$864 |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
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| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | CONSTRUCTION SUBTOTAL | | 89 | | \$0 | | \$2,593 | | \$0 | \$2,593 |
| 23 | LOCATION FACTOR | % | | 81.80% | \$0 | 111.80% | \$2,899 | 100.00% | \$0 | \$2,899 |
| 24 | GRAND TOTAL | | | | \$0 | | \$2,899 | | \$0 | \$2,899 |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | | DATE | | 4/26/96 | |
| TCP | | | | E M C Engineers, Inc. | | | | | | |

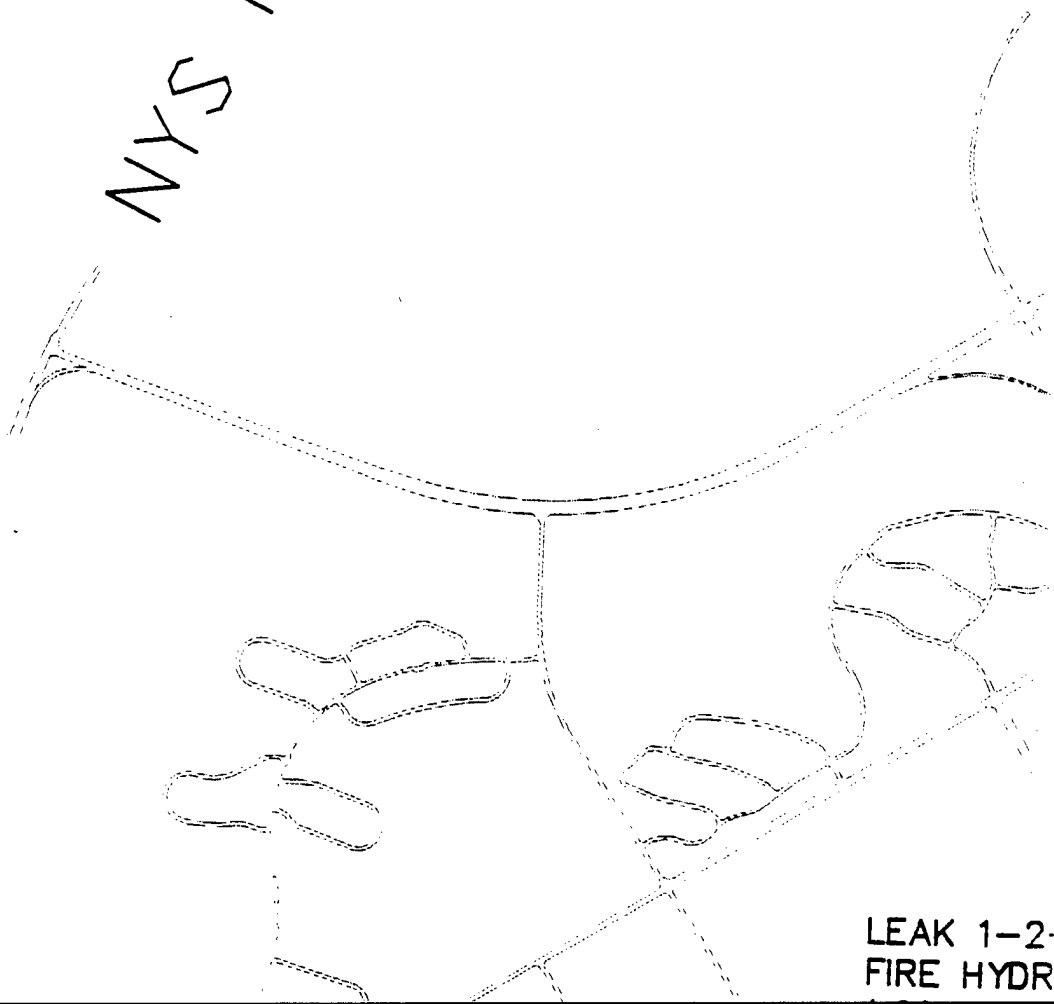
| ENGINEER'S OPINION OF PROBABLE COST | | | | | | | | | | | | |
|-------------------------------------|-----------------------|-----------------|------------------------------|-----------------------|---------------|------------|------------------|----------------|-------|------------|----------|--|
| AREA | | ACTIVITY | LOCATION | | SHEET | | 2 | | OF | | 2 | |
| | | | FT. DRUM, NY | | AMENDMENT NO. | | | | | | | |
| PROJECT TITLE | | | DESCRIPTION | | CONTRACT NO. | | DACA01-94-D-0033 | | | | | |
| WATER CONSERVATION STUDY | | | RECONNECT ISOLATED MAIN LINE | | | | | | | | | |
| Line No. | Item Description | Unit of Measure | Qty. | MATERIAL COST | | LABOR COST | | EQUIPMENT COST | | TOTAL COST | | |
| | | | | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | Unit Cost | Total | |
| 1 | | | | | | | | | | | | |
| 2 | MAIN LINE LEAK REPAIR | EA | 2 | \$237 | \$474 | \$193 | \$386 | \$85 | \$170 | | \$1,030 | |
| 3 | HYDRANT REPLACEMENT | EA | 2 | \$2,502 | \$5,003 | \$793 | \$1,586 | \$57 | \$114 | \$1,401 | \$6,703 | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
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| 13 | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | CONSTRUCTION SUBTOTAL | | | | \$5,477 | | \$1,972 | | \$284 | | \$7,733 | |
| 18 | LOCATION FACTOR | % | | 81.80% | \$4,480 | 111.80% | \$2,205 | 100.00% | \$284 | | \$6,969 | |
| 19 | OVERHEAD & BOND | % | 20 | | \$896 | | \$441 | | \$57 | | \$1,394 | |
| 20 | SUBTOTAL | | | | \$5,376 | | \$2,646 | | \$341 | | \$8,363 | |
| 21 | PROFIT | % | 10 | | \$538 | | \$265 | | \$34 | | \$836 | |
| 22 | SUBTOTAL | | | | \$5,914 | | \$2,910 | | \$375 | | \$9,199 | |
| 23 | CONTINGENCY | % | 10 | | \$591 | | \$291 | | \$37 | | \$920 | |
| 24 | GRAND TOTAL | | | | \$6,605 | | \$3,201 | | \$412 | | \$10,119 | |
| PREPARED BY | | APPROVED BY | | TITLE OR ORGANIZATION | | DATE | | | | | | |
| TCP | | | | E M C Engineers, Inc. | | 4/26/96 | | | | | | |

1

D

NYS RTE 11

C



LEAK 1-2-
FIRE HYDR

2

LEAK 2-1
FIRE HYDRANT ● BLDG. 10270
1,000 GPD (FIXED)

LEAK 2-2
FIRE HYDRANT
1,000 GPD (FIX)

LEAK 2-11
FIRE HYDRANT
1,000 GPD (FIXED)

LEAK 2-
FIRE HYD
1,000 GPD

LE
VA
2,0

LEAK 2-10
FIRE HYDRANT
1,000 GPD (FIXED)

LEAK 2-4
FIRE HYDRANT
1,000 GPD (F

LEAK 2-6
VALVE
500 GPD (FIXED)

LEAK 2-8
FIRE HYDRANT
1,000 GPD
(FIXED)

45TH
DIV.

FOURTH

MEMORIAL DRIVE

4TH ARMORED DIVISION DRIVE

NORTH RIVA RIDGE LOOP

SECOND
STREET WEST

MOUNT BELVEDERE BLVD.
MEMORIAL
DRIVE

SOUTH RIVA RIDGE LOOP

5TH ARMORED DIV. DRIVE

MEMORIAL DRIVE

LEAK 1-2
FIRE HYDRANT
1,000 GPD (FIXED)

3

LEAK 2-2
FIRE HYDRANT
1,000 GPD (FIXED)

LEAK 2-5
FIRE HYDRANT
1,000 GPD (FIXED)

LEAK 2-3
VALVE
2,000 GPD

LEAK 2-4
FIRE HYDRANT
1,000 GPD (FIXED)

LEAK 2-9
FIRE HYDRANT
1,000 GPD (FIXED)

45TH INFANTRY
DIV. DRIVE

LEAK 2-7
FIRE HYDRANT • BLDG. 10050
1,000 HPD (FIXED)

NYS RTE 26

FOURTH ST. EAST

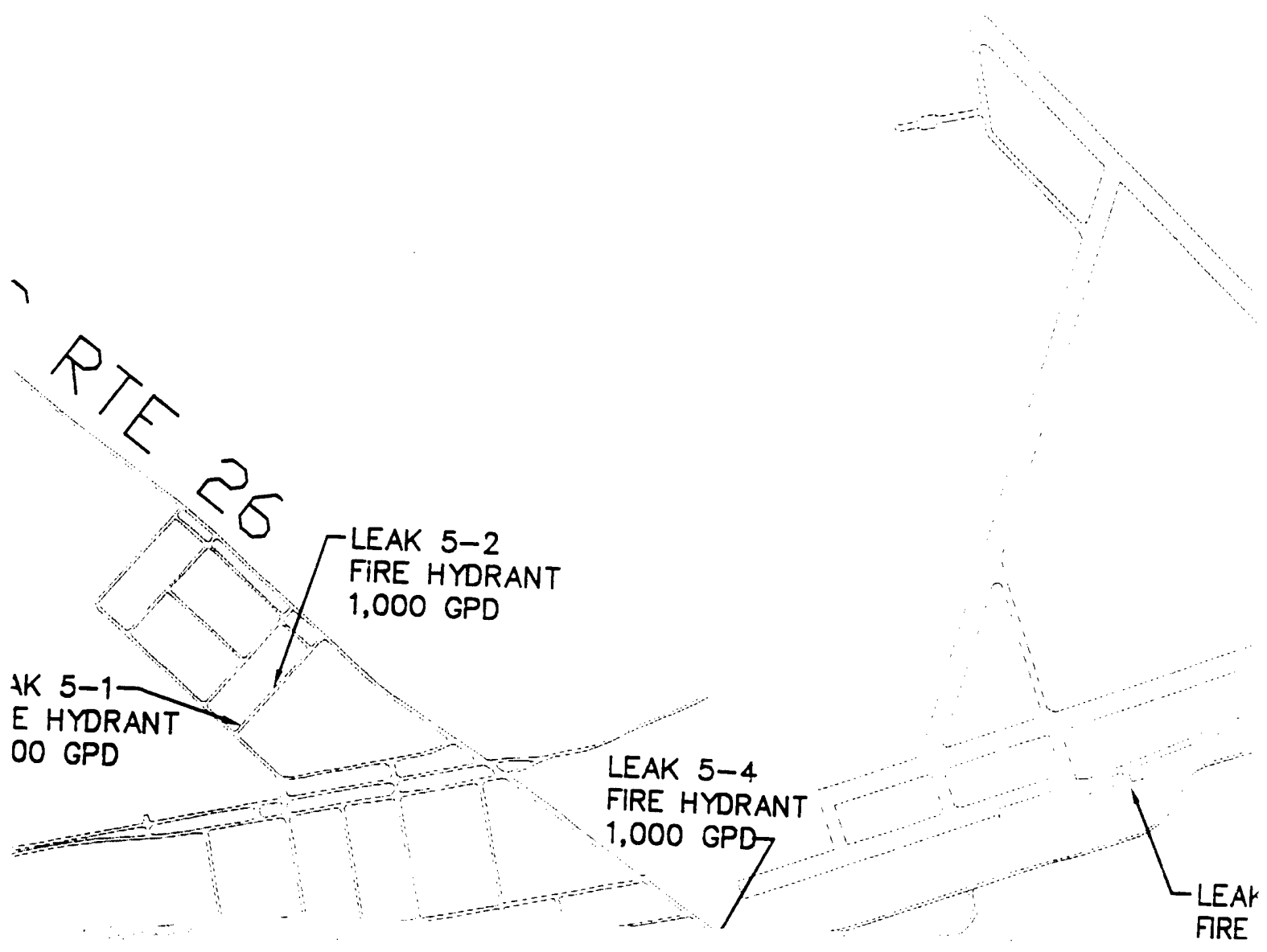
PO VALLEY ROAD

SWIFT ROAD

LEAK 3-2
FIRE HYDRANT • BLDG. 4485
1,000 GPD (FIXED)

LEAK 5-1
FIRE HYDRANT
1,000 GPD

4



NOTES:

1. ROAD DRAWING F
2. FOR MORE SPECIFIC
REFERENCE LEAK
FOR SPECIFIC LEAK
3. LEAKS MARKED "X"
WERE STOPPED BY
SURVEY BY TIGHT



LEAK 6-1
FIRE HYDRANT ● BLDG. 2074

6

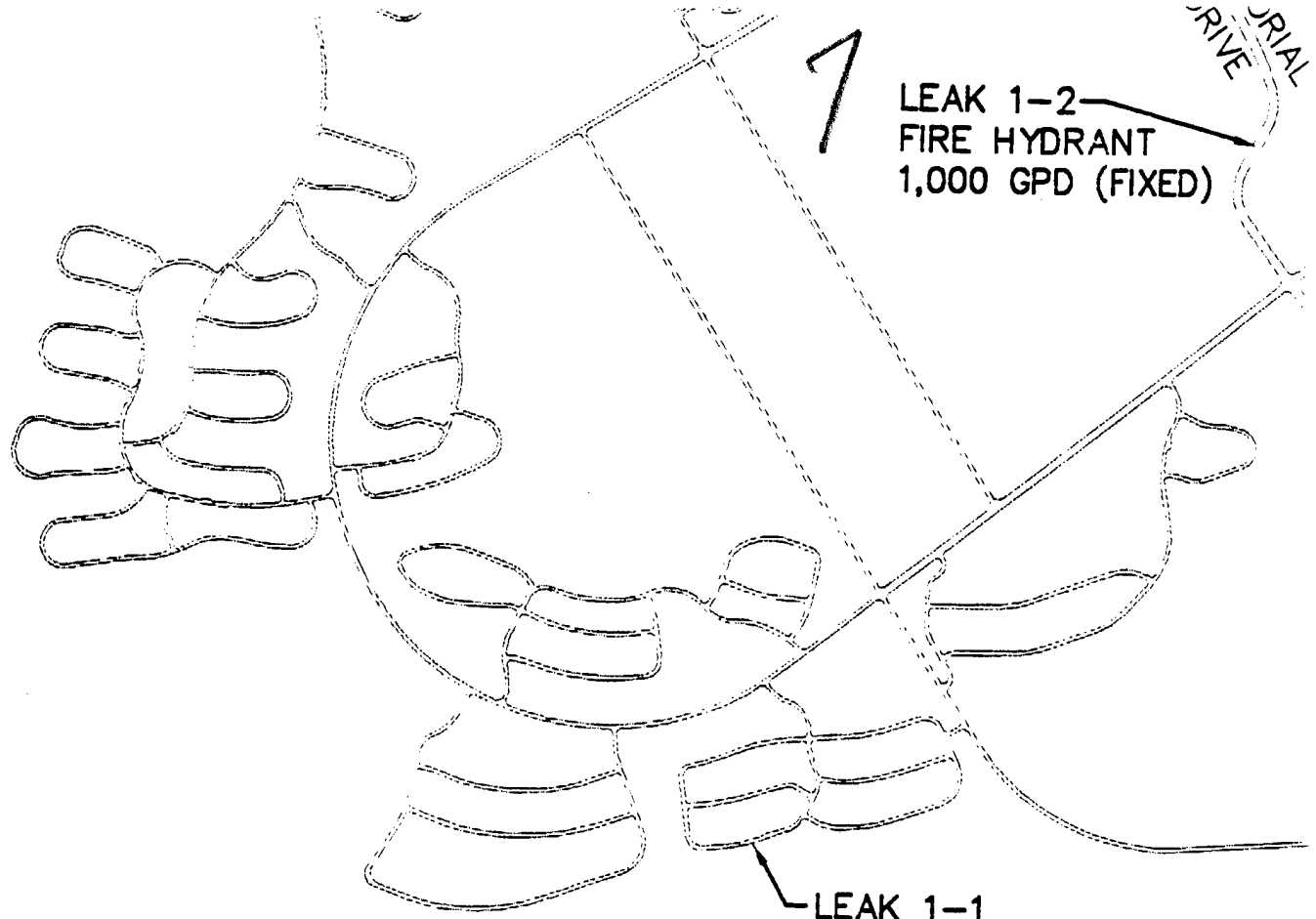
NOTES:

1. ROAD DRAWING FURNISHED BY FT. DRUM
2. FOR MORE SPECIFIC LEAK LOCATION INFORMATION
REFERENCE LEAK LOCATION DIAGRAM IN REPORT
FOR SPECIFIC LEAK
3. LEAKS MARKED "(FIXED)" REPRESENT LEAKS WHICH
WERE STOPPED BY LEAK SURVEY CREW DURING
SURVEY BY TIGHTENING HYDRANT OF VALVE.

D

C

C



7

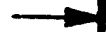
LEAK 1-2
FIRE HYDRANT
1,000 GPD (FIXED)

DRIVE
JURIAL

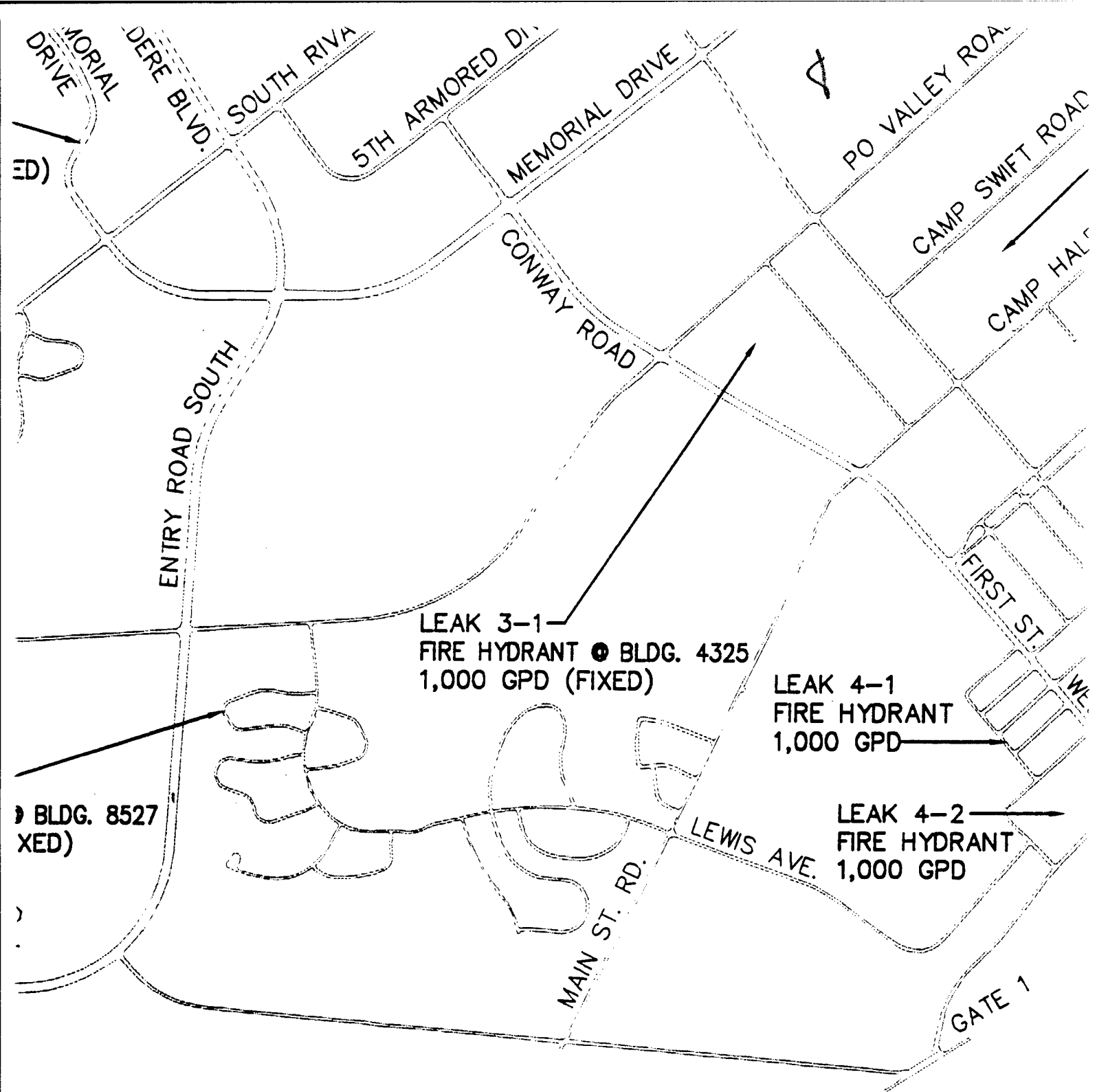
LEAK 1-1
BLDG. 9224
14,000 GPD

LEAK 7-1
FIRE HYDRANT ● BLDG. 85
1,000 GPD (FIXED)

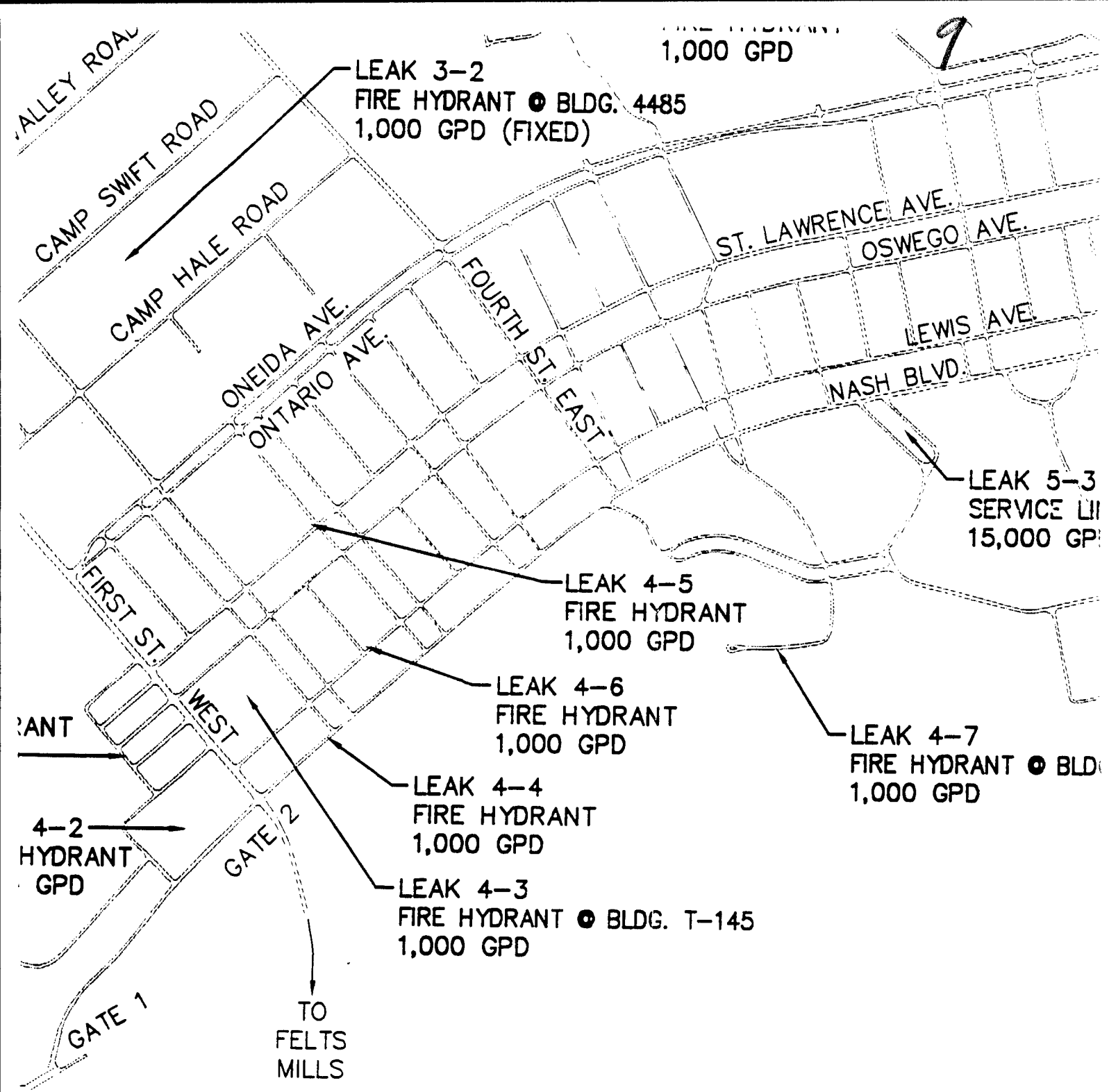
NYS RTE 342



B



LEAK DETECTION SURVEY LEAK LOCATIONS



HYDRANT
0 GPD

10

LEAK 5-4
FIRE HYDRANT
1,000 GPD

LEAK
FIRE H
1,000

LEAK 5-7
FIRE HYDRANT
1,000 GPD

LEAK 5-5
FIRE HYDRANT
1,000 GPD

LEAK 5-3
SERVICE LINE, BLDG. T-2315
15,000 GPD

LEAK 5-6
MAIN LINE, ● BLDG. T-2473
125,000 GPD

LEAK 4-7
FIRE HYDRANT ● BLDG. T-2256
1,000 GPD

ST. LAWRENCE AVE.

OSWEGO AVE.

LEWIS AVE.

NASH BLVD.

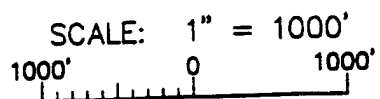
IT

LEAK 6-1
FIRE HYDRANT ● BLDG. 2074
1,000 GPD

T

LEAK DETECTION SURVEY LEAK LOCATIONS

SCALE: 1"=1000'



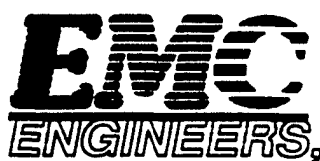
12

5

4

13

| SYMBOL | DESCRIPTION | DATE | APPR |
|--------|-------------|------|------|



• Denver
• Atlanta
• Dallas



US Army Corps
of Engineers

DESIGNED BY:

M. SCHOLZ

DRAWN BY:

M. CARREON

CHECKED BY:

B. CENTER

FORT DRUM
NEW YORK, N.Y.
POTABLE WATER CONSERVATION STUDY
DELIVERY ORDER NO. 012

LEAK DETECTION SURVEY LEAK LOCATIONS

PLOT SCALE:
AS NOTED

CONTRACT DATE:
FEBRUARY 1996

SHEET
REFERENCE
NUMBER

PLOT DATE:
<Plot Date: 02/22/96>

SHEET # OF #

CONTRACT NO.
DACA01-94-D-0033

X

A